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CONTENTS

HISTORICAL SERIES VOLUME 2

		PAGE
No. 1.	Darwin's Journal. By Sir GAVIN DE BEER.	3
No. 2.	Darwin's Notebooks on Transmutation of Species Part I. First Notebook (July 1837–February 1838). Edited by Sir GAVIN DE BEER.	25
No. 3.	Darwin's Notebooks on Transmutation of Species Part II. Second Notebook (February to July 1838). Edited by Sir GAVIN DE BEER.	77
No. 4.	Darwin's Notebooks on Transmutation of Species Part III. Third Notebook July 15th 1838–October 2nd 1938. Edited by Sir GAVIN DE BEER.	121
No. 5.	Darwin's Notebooks on Transmutation of Species Part IV. Fourth Notebook (October 1838–10th July 1839). Edited by Sir GAVIN DE BEER.	153
No. 6.	Darwin's Notebooks on Transmutation of Species Addenda and Corrigenda. Edited by Sir GAVIN DE BEER and M. J. ROWLANDS.	187
No. 7.	Darwin's Ornithological Notes. Edited by NORA BARLOW.	203
	Index to Volume 2.	279

DARWIN'S JOURNAL

SIR GAVIN DE BEER

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DARWIN'S JOURNAL

BRITISH MUSEUM
1 - DEC 1959
NATURAL HISTORY

EDITED BY

SIR GAVIN DE BEER, F.R.S., F.S.A.

Director, British Museum (Natural History)

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THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

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DARWIN'S JOURNAL

Edited by Sir GAVIN DE BEER, F.R.S., F.S.A.

IN his *Autobiography*,[1] Darwin referred to a " little diary, which I have always kept ", in which he recorded the work on which he was engaged, the time which he took in completing each of his researches, the books in which they were described, and his movements from place to place. The document itself was headed " Journal ". Francis Darwin also referred[2] to his father's " Diary or Pocket-book " as having been of great help to him in writing and compiling the *Life and Letters*. He added that " it was unfortunately written with great brevity, the history of a year being compressed into a page or less, and contains little more than the dates of the principle events of his life, together with entries as to his work, and as to the duration of his more serious illnesses ".

Some important quotations have been published[3] from the Journal, such as the famous entry under the date 1837 : " In July opened first note book on ' transmutation of species '. Had been greatly struck from about month of previous March on character of South American fossils, and species on Galapagos Archipelago. These facts origin (especially latter) of all my views ".

The chronological framework which the Journal provides of Darwin's life is of such interest as to deserve publication, and by the courtesy of Sir Charles Darwin, K.B.E., F.R.S. and of the Syndics of the Cambridge University Library, and with the kind help of the Librarian, Mr. H. R. Creswick, M.A., it is printed below.

The manuscript[4] which has been used for transcription is not Darwin's autograph, but a copy made in a fair hand by a copyist who obviously had considerable difficulty in deciphering Darwin's handwriting. In numerous places there are corrections and indications of omissions in pencil in a hand which is presumably that of Francis Darwin. In some places there are duplications and chronological inversions (rationalized in the present transcription), but these occur mostly in the earlier part of the Journal and may have been made in the original autograph manuscript by Darwin himself if, as appears to be the case, the earlier entries were reconstructed from notes and memory at a later date which was probably August 1838 because that date is given at the head of the document, and it is also the date of an autobiographical fragment[5] covering his life up till 1838. That was about the time

[1] *The Autobiography of Charles Darwin*, edited by Nora Barlow, London 1958, p. 116. (Abbreviated as *Autob.*)

[2] *Life and Letters of Charles Darwin*, edited by Francis Darwin, London 1887, vol. 1, p. iv. (Abbreviated as *L. & L.*)

[3] *L. & L.*, vol. 1, p. 330 ; *Charles Darwin. The Foundations of the Origin of Species*, edited by Francis Darwin, Cambridge 1909, p. xiv ; Charles Darwin & Alfred Russel Wallace : *Evolution by Natural Selection*, with a Foreword by Sir Gavin de Beer, Cambridge 1958, pp. 5, and 25.

[4] University Library Cambridge, Darwin MS. 140[2].

[5] *More Letters of Charles Darwin*, edited by Francis Darwin & A. C. Seward, London 1903, vol. 1, p. 1. (Abbreviated as *M.L.*)

when he determined to propose marriage[1] to his cousin Emma Wedgwood; and his balance-sheet of the advantages and disadvantages of the married state, which forms one of the most fascinating subjects which Lady Barlow has added to her Edition of the *Autobiography*,[2] shows how his methodical mind ran to putting things down on paper.

There is also clear evidence of subsequent insertion into earlier entries, as in the case of Darwin's paper on *Flustra*, referred to in the winter of 1826–27 when it was delivered, but which Darwin inserted in 1873 from a footnote published in *Nature* in that year.

From the year 1846 onwards the entries in the Journal are in two columns. The left hand column is clearly designed for entries relating to scientific work, while the right hand column is devoted to personal matters such as journeys to stay with friends or at hydropathic establishments, and dates of birth and death of children and relations. Occasionally, however, the distinction breaks down, as when the length of the period of his illnesses intrudes on the scientific record to justify the time spent on various subjects of research and books.

There is always an element of indiscretion in perusing a document which was never meant by its author for publication, but this one is of such value in throwing light on Darwin's life time-table that it is itself of scientific interest, and, as such, its study by others would not have been frowned on by him. It is presented as a contribution towards the celebration of the centenary of the publication of the book which, as Darwin himself recognized,[3] was the chief work of his life: *On the Origin of Species by means of Natural Selection*, 1859.

JOURNAL

Charles Darwin

1809. Feb. 12. Born at Shrewsbury Parish of St. Chad.
1813. Summer. Went to Gros near Abegele for sea-bathing, some of my earliest recollections dates from this.
1817. Went to Mr Case's[4] School in the Spring (8 years old).
July. My mother[5] died.
1818. July. Went with Erasmus[6] on party of pleasure to Liverpool.
Midsummer. Went to Dr Butlers[7] School.
September. Ill with Scarlet Fever.
1819. July. Went to sea, at Plas Edwards & staid there three weeks.
1820. July. Went tour with Erasmus to Pistyll Rhayader on horseback.

[1] H. E. Litchfield: *Emma Darwin*, Privately Printed, Cambridge 1904, vol. 1, p. 413. (Abbreviated as *E.D.*)
[2] *Autob.*, pp. 231–4.
[3] *Autob.*, p. 122.
[4] *L. & L.*, vol. 1, p. 27.
[5] Susannah (1765–1817), daughter of Josiah Wedgwood I.
[6] Erasmus Alvey Darwin (1804–1881), Darwin's eldest brother.
[7] Samuel Butler (1774–1839), at that time Head Master of Shrewsbury School. Grandfather of Samuel Butler (1835–1902), author of *Erewhon*.

1822. June. Tour with Caroline[1] to Downton. My first recollection of having some pleasure in scenery dates as far back as this. 13 years old.
July. To Montgomery & Bishop's Castle with Elizabeth.[2]
September. To old Mr. Cotton.[3]

1824. November. Marianne[4] was married to Dr Parker.[5]

1825. June 17th. Left Shrewsbury School for ever. 16 years old.
October. Went with Erasmus to Edinburgh.[6]

1826. June 15th. Walking tour into North Wales with Hubbersty.[7]
Oct. 30. Riding tour with Caroline, Vaynor Parle Bala &c.
November 6th. Went to Edinburgh by myself.

1826 } Winter. Examined Marine Animals on shore of Firth of Forth with Dr Grant[8] &
1827 } Coldstream.[9]

1827. In Spring went tour, Dundee, St. Andrews, Stirling. Afterwards Glasgow, Belfast, Dublin & Port. Then London & Paris[10] with Uncle Jo.[11]
" The first paper contributed by him (Mr. Darwin) entitled ' On the Ova of the *Flustra* ' in which he announces that he has discovered organs of motion, and secondly that the small black body hitherto mistaken for the young of *Fucus loreus* is in reality the ovum of *Pontobdella muricata*, exhibits his early habits of minute investigation." (From minutes of Plinian Soc :)[12]
These 2 papers were read by me at close of 1826 or early in 1827 before Plinian Soc : in Edinburgh. My first paper 2d year in Edinburgh. I was then 18 years old.
In the Autumn paid many visits to Woodhouse.[13]
September. Maer[14] & Sir J. Mackintosh.[15]
Christmas. Went to Cambridge.[16]

1827 } Became acquainted with Fox[17] & Way[18] & so commenced Entomology.
1828 }

[1] Caroline Sarah Darwin (1800–1888), Darwin's sister, afterwards wife of Josiah Wedgwood III.

[2] Susan Elizabeth Darwin (1803–1866), Darwin's sister.

[3] Mr. Cotton of Shropshire pointed out to Darwin the erratic block in Shrewsbury known as the " Bell Stone " and told him that there was no similar rock nearer than Cumberland or Scotland. (*L. & L.* vol. 1, p. 41 and *Autob.*, p. 52.)

[4] Marianne Darwin (1798–1858) Darwin's eldest sister.

[5] Henry Parker (1788–1856).

[6] Darwin signed the Matriculation Book of the University on 22 October 1825. (J. H. Ashworth : " Darwin as a Student in Edinburgh 1825–1827 ", *Proc. Roy. Soc. Edinb.*, vol. 55, 1935, p. 97.)

[7] Probably Nathan Hubbersty (1803–1881) who was Assistant Master at Shrewsbury School 1826–8. (J. A. Venn : *Alumni Cantabrigienses*, pt. II, vol. 3, p. 470, Cambridge 1947.)

[8] Robert Edmund Grant (1793–1874). (J. H. Ashworth : *op. cit.* ; and P. H. Jespersen : " Charles Darwin and Dr Grant ", *Lychnos* 1948–49 (Uppsala 1950), p. 159.)

[9] John Coldstream, ob. 1863.

[10] This was the only occasion when Darwin visited the Continent.

[11] Josiah Wedgwood II (1769–1843), brother of Darwin's mother.

[12] This entry is inserted from a footnote in *Nature* November 20, 1873, p. 38, and it shows that Darwin inserted it at this place in his diary in that year.

[13] Woodhouse, near Shrewsbury, home of the Owen family. (*cf. E.D.*, vol. 1, p. 180.)

[14] Maer Hall, 7 miles from Stoke upon Trent, Staffordshire, home of Josiah Wedgwood II. (*Autob.*, p. 54.)

[15] Sir James Mackintosh (1765–1832), whose wife Catherine née Allen was the sister of Elizabeth, wife of Josiah Wedgwood II.

[16] The Admittance Book at Christ's College shows that Darwin was admitted on 15 October 1827. (*cf. Christ's College Magazine Darwin Centenary Number*, vol. 23, Cambridge 1909, p. 189.)

[17] William Darwin Fox (*c.* 1805–1880), grandson of William Alvey Darwin, brother of Erasmus Darwin (1731–1802) Darwin's grandfather. William Darwin Fox was therefore Darwin's second cousin.

[18] Albert Way (1805–1874). (*cf. Autob.*, p. 63.)

1828. Very keen in collecting insects in the Spring at Cambridge & at Barmouth in the Autumn.
Summer. Went to Barmouth (with Herbert[1] & Butler[2]) to read with Butterton.[3]
September. Maer & thence to Osmaston Hall[4] for Music Meeting.

1829. Summer. Paid Barmouth a visit.
October. Birmingham, Music meeting with Wedgwoods.

1830. Christmas. Vacation spent at Cambridge. Continued to collect insects, to hunt shoot & be *quite* idle.
Christmas passed my examination[5] for B.A. degree & kept the two following terms.

1831. During these months lived much with Prof[r] Henslow[6] often dining with him & walking with [him], became slightly acquainted with several of the learned men in Cambridge, which much quickened the zeal which dinner parties & hunting had not destroyed.
In the Spring paid Mr. Dawes[7] a visit with Ramsay,[8] Kirby[9] & talked over an excursion to Teneriffe.[10] In the Spring Henslow persuaded me to think of Geology & introduced me to Sedgwick.[11]
During Midsummer Geologized a little in Shropshire.
August. Went on Geological tour by Llangollen, Ruthven, Conway, Bangor & Capel Curig where I left Professor Sedgwick & crossed the mountains to Barmouth. Returned to Shrewsbury at end of August. Refused offer of Voyage.[12]
Sept. Went to Maer returned with Uncle Jo to Shrewsbury[13] thence to Cambridge.[14] London.[15]

[1] John Maurice Herbert (1808–1882). (J. A. Venn: *Alumni Cantabrigienses*, pt. II, vol. 3, p. 338, Cambridge, 1947. *cf. L. & L.*, vol. 1, pp. 49, 164, 166 ff.)

[2] Probably Thomas Butler (1806–1886), son of Samuel Butler Head Master of Shrewsbury School, B.A. Cantab 1829. (J. A. Venn: *Alumni Cantabrigienses*, pt. II, vol. 1, p. 478, Cambridge 1940.)

[3] George Ash Butterton (1805–1891).

[4] Osmaston Hall, near Derby. William Alvey Darwin (1726–1783) of Sleafort, eldest brother of Erasmus Darwin (1731–1802) (Darwin's grandfather), had a daughter Anne who married Samuel Fox of Osmaston. Their son was William Darwin Fox.

[5] Darwin was placed 10th in the list of January 1831 of successful candidates who did not seek Honours. (*cf. Autob.*, p. 59.)
Darwin was admitted B.A. on 26 April 1831. (*L. & L.*, vol. 1, p. 163.)

[6] John Stevens Henslow (1796–1861).

[7] Richard Dawes (1793–1867).

[8] Marmaduke Ramsay (*ob.* 1831), brother of Sir Alexander Ramsay 2nd Bart., admitted to Jesus College, 1814, Tutor of Jesus College. (*cf. L. & L.* vol. 1, p. 54.)

[9] William Kirby (1759–1850), was at that date 71 years old; if not he, unidentified.

[10] In anticipation of his visit to Tenerife, Darwin learned Spanish, an accomplishment which must have been of the greatest value to him when visiting South America in the Beagle. (*cf. L. & L.*, vol. 1, p. 190.) It is not generally known that Darwin also contemplated a voyage to South America. This emerges from the following letter addressed by the Hydrographer of the Navy, Captain Francis Beaufort R.N. (1774–1857), to Captain Robert FitzRoy R.N., for the text of which I am indebted to Rear-Admiral K. St. B. Collins, R.N., O.B.E., D.S.C., Hydrographer of the Navy.

Sep[r] 1 1831

Cap[n] Fitzroy

My dear Sir,

I believe my friend Mr. Peacock of Trin[y] College Camb[e] has succeeded in getting a "Savant" for you—A Mr. Darwin grandson of the well known philosopher and poet—full of zeal and enterprize and having contemplated a voyage on his own account to S. America.

Let me know how you like the idea that I may go or recede in time.

F. B.

[11] Adam Sedgwick (1785–1873).

[12] Darwin's letter of refusal to Henslow was dated 30 August 1831 (*L. & L.*, vol. 1, p. 195.) The fact that Darwin had himself contemplated a voyage to South America on his own account (see footnote 10) must have made this refusal all the more painful.

[13] Josiah Wedgwood's drive from Maer to Shrewsbury to persuade Darwin's father to allow Darwin to sail in the Beagle was on 1 September 1831. (*Autob.*, pp. 71, 226 ff.)

[14] Darwin went to Cambridge on 2 September 1831. (*L. & L.*, vol. 1, p. 199; *Autob.*, p. 72.)

[15] Darwin was at 17 Spring Gardens in London by 5 September, 1831. (*L. & L.*, vol. 1, p. 201.)

Sept. 11 Went with Capt. FitzRoy[1] in Steamer to Plymouth to see the Beagle.[2]
Sept. 22nd Returned to Shrewsbury passing through Cambridge.
Oct. 2nd Took leave of my home, staid in London.
Oct. 24th Reached Plymouth.
October & November. These months very miserable.
December 10th Sailed, but were obliged to put back.
,, 21st Put to sea again & were driven back.
,, 27th Sailed from England on our Circumnavigation.

1832. Jan. 16th First landed on a tropical shore (St. Jago).
Feb. 29th Landed at Brazil.
Dec 2 ,, ,, Tierra del Fuego.

1833. Dec 6th Sailed for last time from Rio Plata.

1834. June 10th Sailed for last time from Tierra del Fuego.

1835. Sept. 15th Sailed from West Shores of South America.

1836. May 31 Anchored at the Cape of Good Hope.
October 2nd Anchored at Falmouth.
,, 4th Reached Shrewsbury after absence of 5 years and 2 days.
,, 14th London.
,, 15th Cambridge.
,, 20th London.
,, 28th Beagle arrived at Woolwich, was paid off, November 17th.
November 12th Maer.
,, 16th Shrewsbury.
December 2nd London.
,, 13th Cambridge.

1837. Jan. Cambridge, time spent in arranging general collection examining minerals, reading & writing little Journal in the evening. Paid two short visits to London & Read paper on elevation of Coast of Chile.[3]
March 6th Left Cambridge to reside in London.
,, 13th Entered my Lodgings in 36 Gt Marlborough St.
May. Paper on Coral formation[4] to Geolog. Soc: ditto. on deposits in Pampas.[5]
In July opened first note book on "Transmutation of Species"—Had been greatly struck from about Month of previous March on character of S. American fossils—& species on Galapagos Archipelago. These facts origin (especially latter) of all my views.
From March 13th to end of September entirely employed in my Journal.[6]
June 26th Short visit to Shrewsbury.
Sept. 25th Shrewsbury returned by Maer & reached London Oct. 21st.
Nov. 20th Two days Isle of Wight to see Fox.

[1] Robert FitzRoy (1805–1865).

[2] A brief history of H.M.S. *Beagle* is given in Sir Gavin de Beer: "Some unpublished letters of Charles Darwin", Appendix II. *Notes and Records of the Royal Society of London*, vol. 14, 1959.

[3] Charles Darwin: "Observations of proof of recent elevation on the coast of Chile, made during the Survey of H.M.S. *Beagle*, commanded by Capt. FitzRoy", read January 4, 1837. *Proc. Geol. Soc.*, vol. 2, 1838, p. 446.

[4] Charles Darwin: "On certain areas of elevation and subsidence in the Pacific and Indian Oceans, as deduced from the study of coral formations", read May 31, 1837. *Proc. Geol. Soc.*, vol. 2, 1838, p. 552.

[5] Charles Darwin: "A sketch of the deposits containing extinct Mammalia in the neighbourhood of the Plata," read May 3, 1837. *Proc. Geol. Soc.*, vol. 2, 1838, p. 542.

[6] Charles Darwin: *Journal of Researches into the Geology and Natural History of the various countries visited by H.M.S. Beagle under the command of Capt. FitzRoy, R.N. from* 1832–1836. London 1839.

October–November preparing scheme of Zoology of Voyage of Beagle,[1] commenced Geology[2] & finished proofs of Journal—Paper on Worms forming mould.[3]

1838. Jan. 17th I finished my account of the Geology of the Galapagos Arch : & of Ascension.

Feb. 25—Finished St. Helena & small islands in Atlantic. Also speculated much about " Existence of Species " & read more than usual.

March—Part. Mammalia in Zoology. Paper on earthquakes[4] for Geolog. Soc :

April. Part. Birds for Zoology. Much time thus lost.

,, 16th Began Geolog : Cape of Good Hope. King George Sound, Sydney.

May 1st Unwell, working at Geolog: as named and " species ".

,, 10th Went to Cambridge for 4 days.

,, 15th Began Geolog : of Hobart Town & New Zealand.

,, 22nd Began Geolog : of St Jago. Cape de Verdes.

June (Beginning). Preparing 1st part of Birds. St Jago Geology some little species theory, & lost very much time by being unwell.

June 23rd Started in Steam Boat for Edinburgh (one day Salisbury Craigs).[5] Spent eight good days in Glen Roy returned by sea through Greenock, & Liverpool. Slept at Overton & reached Shrewsbury July 13th. Very idle at Shrewsbury, some notes from my Father. Opened note book connected with metaphysical enquiries.

July 29th Set out for Maer.

August 1st London. Began paper on Glen Roy and finished it.

August. Read a good deal of various amusing books & paid some attention to Metaphysical subjects.

Sept. 6th Finished paper on Glen Roy[6] one of the most difficult & instructive tasks I was ever employed on.

Spt. 14th Frittered these foregoing days away on working on Transmutation theories & correcting Glen Roy. Began Crater of Elevation theory.

All September read a good deal on many subjects ; thought much upon religion. Beginning of October ditto.

October 5th Began Coral Paper[7] requires much reading.

,, 25th Went to Windsor for two days rest, glorious weather, delightful.

October 27th Preface & Addenda on Theory of Erratic Blocks[8] to Journal.

November 9th Started for Maer.

,, 11th Sunday. The day of days![9]

Went to Shrewsbury the next day returned to Maer on the 17th & to London on the 20th.

[1] Ultimately published as " *Zoology of the Voyage of H.M.S. Beagle, edited and superintended by Charles Darwin,* London 1840–1843.

[2] Ultimately published as *Geology of the Voyage of H.M.S. Beagle.* London 1842–46.

[3] Charles Darwin : " On the formation of mould ", read November 1, 1837. *Proc. Geol. Soc.*, vol. 2, London 1838, p. 574, *Trans. Geol. Soc.*, vol. 5, 1840, p. 505.

[4] Charles Darwin : " On the Connexion of certain Volcanic Phenomena and on the formation of mountain-chains and the effects of continental elevations ", read March 7, 1838. *Proc. Geol. Soc.*, vol. 2, 1838, p. 654, *Trans. Geol. Soc.*, vol. 5, 1840, p. 601.

[5] At Edinburgh University, Darwin heard Professor Robert Jameson (1774–1854), a confirmed Neptunist, refer to trap-dykes at Salisbury Craigs as a fissure filled with sediment from above. (*Autob.*, p. 53.)

[6] Charles Darwin : " Observations on the Parallel Roads of Glen Roy, and of other parts of Lochaber in Scotland, with an attempt to prove that they are of marine origin ", *Phil. Trans. Roy. Soc.*, 1839, p. 39.

[7] Ultimately published as *The Structure and Distribution of Coral Reefs. Being the First Part of the Geology of the Voyage of the Beagle.* London, 1842.

[8] Charles Darwin : " Note on a Rock seen on an Iceberg in 16° South Latitude ", *J. Geogr. Soc.*, vol. 9, 1839, p. 528.

[9] The day of the acceptance of Darwin's proposal of marriage by Emma Wedgwood (1808–1896), daughter of Josiah Wedgwood II (1769–1843).

Lost 7th 8th of November unwell. Wasted entirely the last week of November. Beginning of December prepared number of Birds—From 6th to 21st busy about the House & domestic concerns. To the end of year House hunting, read a little and wasted some time by being unwell.

December 6th Emma came up to Town most fortunately for me.
December 21st Emma went to Maer.
December 31st Entered 12 Upper Gower St.[1]

1839. First week January correcting Glen Roy paper. Did nothing during rest of month.
Jan 11th Went to Shrewsbury.
,, 15th ,, ,, Maer.
,, 18th ,, ,, London.
,, 25th Shrewsbury.
,, 28th Maer.
Jany 29th Married at Maer 30 years old & returned to London.
Feb. 5th Began German.
Feby 7th Recommenced Coral Paper.
End of February & first week in March Earthquake Paper then a little work on Species & the Coral Paper.
End of March & nearly all April Coral Paper.
April 26th Went to Maer. Maer visit, some reading connected with Species but did very little on account of being unwell.
May 13th went to Shrewsbury.
,, 20th went to London.
May 20th to July 30th Map for Coral Island.[2] Ornithological part of Beagle's Voyage. —lost some time unwell, read little for Species ; to 23rd of August. Coral Map & Horticult[l] Transact :
Aug. 23rd to Maer and thence on the 26th to Birmingham for the Meeting of the British Assoc :
Sept. 12th to Shrewsbury & staid there ten days.
Oct. 2nd Arrived in London.
December 27th A Boy[3] born at ½ p. 9 a.m.
During my visit to Maer, read a little, was much unwell, & scandalously idle. I have derived this much good that *nothing* is so intolerable as idleness. The last week corrected earthquake paper. Begin. of Octob[r] correcting ditto. Ornithology. October 10th recommenced coral paper.
December 24th became unwell & with the exception of 2 or 3 days remained so till the 24th of February In the interval read a little for transmut. theory—but otherwise lost three whole months.

1840. Again became unwell & did not commence coral volume till March 26th.
April 3rd Went to Shrewsbury for a week by myself. Did Coral Volume.
June 10th Went to Maer & paid a visit to Shrewsbury.
Aug. 4 Taken ill.
Nov. 14 Came up to London. During the summer when well enough did a good deal of Species work.
Dec. 15th Commenced last number of Birds for Zoology of Beagle's Voyage. Finished Feb. 20th 1841.

[1] 12 Upper Gower Street, the Darwins' home from 1839 until September 1842. This house, renumbered 110 Gower Street, was destroyed by a bomb early in 1941.

[2] The map published in *Structure and Distribution of Coral Reefs ;* it shows atolls dark blue, reefs pale blue, and fringing reefs red, from which Darwin was able to show the previous elevation and subsidence of different areas of the earth's surface.

[3] William Erasmus Darwin (1839–1914).

1841. Commenced paper on. Boulders & Till of S. America[1]—finished April 4th. Was idle & unwell.

March 2nd Annie[2] born. Sorted papers on species theory.

May 28th Went to Maer & Shrewsbury reading very little returned to London July 23rd.

July 26th commenced coral work after more than 13 months interval.

1842. Jan. 3. Sent MS. of Coral to Printers.

March 7th Went to Shrewsbury for 10 days.

May 6th Corrected last proof of Coral volume. I commenced this work 3 years & 7 months ago. Out of this period about 20 [months] (besides work during Beagle Voyage) has been spent on it & besides it I have only completed the Bird part of Zoology : Appendix to Journal—Paper on Boulders & corrected Paper on Glen Roy & earthquakes, reading on Species & rest all lost by illness.

May 18th Went to Maer.

June 15th to Shrewsbury & on 18th to Capel Curig. Bangor. Carnarvon to Capel Curig altogether ten days, examining glacier action. During my stay at Maer & Shrewsbury (5 years after commencement) wrote pencil sketch of my Species theory.[3]

July 18th returned to London. Wrote paper on Glaciers.[4]—copied notes on Species. Employed about Down[5]—Emma came to Down September 14th & I followed on 17th.

Sept 23rd Mary Eleanor[6] born. Ob : October 16th.

October 14th began on Volcanic Islands[7] to shorten and rearrange Covington's[8] MS.

1843. July 8th to Maer & Shrewsbury for a week.

July 12th Josiah Wedgwood[9] died. Previous to this did little in the Spring from Building[10] except some species work, & returned to volcanic Islands on my return.

September 25th Henrietta Emma[11] born.

October 12th to Shrewsbury for 12 days. Paper on Sagitta[12] and on seeds,[13] preservation of. Sixteen months about Volcanic Isld Book.

1844. Jan. 5th Sent MS. of Volcanic Islands to Printers.

Feb. 13th finished corrections. In intervals & previously slowly enlarged & improved pencil sketch in 35 pages (written in Mid-summer of 1842) of Species theory[14].

April 23rd to Maer & Shrewsbury, returned May 30th.

[1] Charles Darwin : " On the Distribution of the Erratic Boulders and on the Contemporaneous Unstratified Deposits of South America ", *Proc. Geol. Soc.*, vol. 3, 1842, p. 425, read May 5, 1841 ; *Trans. Geol. Soc.* vol. 6, 1842, p. 415.

[2] Anne Elizabeth Darwin (1841–1851).

[3] Printed in *The Foundations of the Origin of Species*, edited by Francis Darwin, Cambridge 1909 ; and in *Evolution by Natural Selection*, with a Foreword by Sir Gavin de Beer, Cambridge, 1958.

[4] Charles Darwin : " Notes on the Effects produced by the Ancient Glaciers of Caernarvonshire, and on the Boulders transported by Floating Ice ", *Lond. Philos. Mag.*, vol. xix, 1842, p. 180.

[5] Down House, Kent was Darwin's home for the remainder of his life.

[6] Mary Eleanor Darwin (born and died 1842).

[7] Charles Darwin : *Geological Observations on the Volcanic Islands and parts of South America visited during the Voyage of the H.M.S. Beagle. Being the Second part of the Geology of the Voyage of the Beagle* London 1844.

[8] Syms Covington *c.* 1816–1861 ; Darwin's attendant in the *Beagle* and amanuensis after his return until 1839. (*cf.* Sir Gavin de Beer : " Some unpublished letters of Charles Darwin ", *Notes and Records of the Royal Society of London*, vol. 14, 1959.)

[9] Josiah Wedgwood II, Darwin's uncle and father-in-law.

[10] (*cf. L. & L.* vol. 1, p. 321.)

[11] Henrietta Emma Darwin (1843–1929), afterwards Mrs. Litchfield.

[12] Charles Darwin : " Observations on the Structure and Propagation of the genus *Sagitta* ", *Ann. Mag. Nat. Hist.*, vol. 13, 1844, p. 1.

[13] Ultimately published as " Vitality of Seeds ", *Gardeners' Chronicle*, 1855, p. 758 ; and " On the Action of Sea-water on the Germination of Seeds ", *J. Linn. Soc. Lond.*, (*Bot.*) vol. 1, 1857, p. 130.

[14] Printed in *The Foundations of the Origin of Species*, edited by Francis Darwin, Cambridge 1909 ; and *Evolution by Natural Selection*, with a Foreword by Sir Gavin de Beer, Cambridge 1958.

July 5th Sent a written Sketch of Species theory (seven years after commencement) in about 230 pages to Mr. Fletcher[1] to be copied—Corrected it last week in Sept :

Paper on Atlantic Dust,[2] on Planariae.[3] Sorted my collections.

July 27th Began S. America.[4]

October 18th to 29th at Shrewsbury.

1845. April 24th Finished first time over S. America (9 months)

April 25th Began 2nd Edit of Journal.[5] August 25th finished ditto (4 months). Rested idle for a fortnight.

April 29th to Shrewsbury returned 10 May.

July 9th George Howard[6] born.

Sept. 15th to Shrewsbury. Lincolnshire—York, the Dean of Manchester,[7] Waterton,[8] Chatsworth,[9] Camp Hill,[10] returned home Oct. 26th.

Oct. 29th Recommenced Geolog : of S. America. 4000 Copies of New Edit of Journal sold at Jan. 1. 1847.

1846. Oct. 1. Finished last proof of my Geolog: Observations in S. America. This volume including paper in Geolog: Journal on the Falkland Islands took me 18 & ½ months. The MS. however was not so perfect as in case of Volcanic Islands so that my Geology has taken me 4 & ½ years : now it is 10 years since my return to England. How much time lost by illness.

Oct. 1. Paper on new Balanus Arthrobalanus[12] 10 days in London during 2 visits 4 visitors here & some days unwell.

November, December, Conia & Megatrema.

1847. Jan. 1. Conia.

Feb. Balanus.

March Acasta & Clisia.

April 14th Lost several weeks by

1846. Feb 21st to Shrewsbury, March 3rd home.

July 31st to ditto Aug. 9th Home.

September 9th with Emma to Brit Assoc at Southampton, on the 12th to Portsmouth & coast of Isle of Wight, on 13th to Winchester & S. Cross, on 14th Netley Abbey & Southampton Common 17th Home.

September 22nd With Em & Susan to Knole Park.[11]

1847. Feb. 19th to Shrewsbury March 5th Home.

June 22nd to Brit. Assocn at Oxford. Blenheim, Nuneham, Dropmore, Burn-

[1] Mr. Fletcher : unidentified. Later Darwin employed Ebenezer Norman, appointed schoolmaster in the village of Downe in 1854, to copy manuscripts for him.

[2] Charles Darwin : " An Account of the fine Dust which often falls on vessels in the Atlantic Ocean ", *J. Geol. Soc.*, vol. 2, 1846, p. 26.

[3] Charles Darwin : " Brief Description of several terrestrial *Planariae*, and of some remarkable marine species, with an account of their habits ", *Ann. Mag. Nat. Hist.*, vol. 14, 1844, p. 241.

[4] Charles Darwin : *Geological Observations on South America. Being the Third part of the Geology of the Voyage of the Beagle.* London 1846.

[5] Charles Darwin : *Journal of Researches into the Natural History and Geology of the countries visited during the Voyage of H.M.S. Beagle round the world, under the command of Captain Fitzroy, R.N.* London 1845.

[6] George Howard Darwin (1845–1912).

[7] The Hon. and Rev. William Herbert (1778–1847), the distinguished plant geneticist. (*cf. L. & L.*, vol. 1, p. 343.)

[8] Charles Waterton (1782–1865). (*cf. L. & L.*, vol. 1, p. 343.)

[9] (*cf. L. & L.*, vol. 1, p. 344.)

[10] Camp Hill, Staffs, home of Sarah Elizabeth Wedgwood (1778–1856).

[11] Knole Park (or Knowle Park) near Sevenoaks.

[12] This was the start of Darwin's work on the Cirripedia, but the paper on Arthrobalanus does not seem to have been published.

1847—(*contd.*)

Boils & unwellness. Tubicinella Coronula.

Dec. 18th Anat of Pedunculated Cirres.

From Jan. 1st 1847 to Jan 1848, 236 copies sold of my Journal by Murray. Total up to Jan. 1. 1848, 4100.

1848. March 20. Finished Scientific Instructions[1] & Transportal of Boulders from Lower to Higher level.[2]

April 19th Paper read on Transportal of Boulders. Both these done in Intervals of Work.

About Novr 1. Began species of Anatifera—Jan: 13. 49 finished ditto.

From July to end of year, unusually unwell, with swimming head, depression, trembling, many bad attacks of sickness.

1849. Jan 1st to March 10th Health very bad with much sickness & failure of power. Worked on all well days.

March 10th to June 30th, at the Lodge Malvern,[5] perfectly idle, health greatly improved.

July 13th Recommenced systematic part of the pedunculate Cirripedia. Recent & Fossil.

1850. Apr 28th Commenced systematic Sessilia.

Dec. 30. finished Balanus & Pachylasma.

ham Beeches home July 1st.

October 22nd to Shrewsbury—Nov. 5th Home.

1848. May 17th to Shrewsbury June 1st Home.

July 22nd to Swanage by Wareham & Corfe Castle. Home 29th by Sir W. Symonds[3] yacht. Poole spending a morning in new forest.

Oct[r] 10th to Shrewsbury Oct 25th Home.

Nov 17th to ditto Novr 26th Home.

My father[4] died in morning of Novr 13th in his 83rd year. Born at Lichfield on May 30th 1766. He was 3rd son of Erasmus Darwin (born at Elston in 1731. Settled in Shrewsbury about 1786.)

1849. Septr 11th to 21st Brit Assoⁿ at Birmingham going to Malvern on the Sunday.

1850. June 11th to 18th Malvern.

Augt 10th to 16th Leith Hill.[6]

Octr 14th Hartfield[7] — 18th to Ramsgate 22nd Home.

[1] Darwin contributed Section VI (Geology) to a *Manual of Scientific Enquiry; prepared for the use of H.M. Navy: and adapted for travellers in General*, edited by Sir John Herschel, London 1849.

[2] Charles Darwin: "On the transportation of Erratic Boulders from a lower to a higher level", *J. Geol. Soc.*, vol. 6, 1848, p. 315, read April 19.

[3] Rear-Admiral Sir William Symonds (1782–1856), Surveyor of the Navy.

[4] Robert Waring Darwin.

[5] Darwin took the Lodge, Great Malvern, to enable him to undergo the water-cure.

[6] Leith Hill Place, home of Josiah Wedgwood III (1795–1880), brother of Darwin's wife, husband of Darwin's sister Caroline, and Darwin's first cousin.

[7] There were two houses at Hartfield Sussex, which the Darwin family frequented. One was Hartfield Grove, home of Charles Langton (1801–1866) and his wife Charlotte Wedgwood (1797–1862), sister of Josiah Wedgwood and of Darwin's wife. The other was The Ridge, home of Sarah Elizabeth Wedgwood (1793–1880). They were given up in 1862. (*cf. E.D.* ii, p. 199.)

1851. Early part finished fossil Lepadidae[1] prepared for press recent Lepadidae.[2]

Aug^{t} 18th began proofs.

Nov 12th Finished ditto & began Genus Conia (or Sessile C^{s}) & Elminius.

1852. Whole year Sessile Cirriped Genera Acasta, (Pyrgoma & Escuria 41 days) Coronula (19 days), Platylepas, Tubicinella, Xenobalanus, Chelonobia (Chthamalus 36 days) Chamaesipho, Octomeris, Catophragmus, Balanus recommenced : M^{r} Sowerby's[6] drawings Balanidae. Began Verruca.

1853. Whole year preparing MS. of Sessile Cirripeds for press viz. Verruca, Cryptophialus, Alcippe. M^{r} Sowerby for drawing Sept. 20 Class Cirripedia.

1854. Feb 3 First proof of Sessile Cirripedia.[10]

July 15 Final Revise of ditto.

Sept 9th Finished packing up all my Cirripedes preparing fossil balanidae distributing copies of my work &c. &c. &c. I have yet a few proofs for Fossil Balanidae[12] for Pal: Soc: to complete perhaps a week more work. Began Oct 1 1846. On Oct 1 it will be 8 years since I began! but then I have lost 1 or 2 years by illness.

Sept 9 Began sorting notes for Species theory.[14]

1851. March 24th to Malvern with Annie & Etty,[3] returned home 31st.

April 16th started for Malvern April 23rd our dear child[4] expired 24th. I returned to Emma, our darling was born March 2nd 1841.

July 30th to London Aug^{t} 10th returned Erasmus house[5] for Exhibition &c.

1852. March 24th to Rugby for a day thence to Shrewsbury, Home April 1st.

Sept^{r} 11 to Leith Hill 16th Home again (Drove in Carriage by Godstone & Reigate).

1853. July 14th to Eastbourne[7] on to Brighton & Hastings. Home Aug^{t} 4th.

Aug^{t} 13th to Hermitage[8] for Chobham 17th Home.

Nov 30. Royal Medal[9] given to me.

1854. March 13th to Hartfield on account of Franky's[11] illness returned on 17th.

July 13–15 Hartfield.

Oct 9th 14th Leith Hill.

Dec. Lenny[13] & Franky ill.

[1] Charles Darwin : *A Monograph of the Fossil Lepadidae*, Palaeontographical Society, 1851.
[2] Charles Darwin : *A Monograph of the Sub-class Cirripedia*, Ray Society, London 1851, vol. 1.
[3] Henrietta Emma Darwin (1843–1929), afterwards Mrs. R. B. Litchfield.
[4] Anne Elizabeth Darwin.
[5] 7 Park Street, W.1., home of Erasmus Alvey Darwin (1804–1881), Darwin's brother.
[6] George Brettingham Sowerby (1812–1884).
[7] The Darwins took Sea House, Eastbourne for 3 weeks in July, 1853.
[8] The Hermitage, near Woking, home of Henry Allen Wedgwood (1779–1885), brother of Josiah Wedgwood III and of Darwin's wife. (*cf. E.D.*, ii, p. 168.)
[9] The Royal Medal of the Royal Society " awarded for his work entitled Geological Observations on Coral Reefs, Volcanic Islands, and South America and his work on the Fossil Cirripedia of Great Britain, Lepididae, and the Monograph on Cirripedia."
[10] Charles Darwin : *A Monograph of the Sub-class Cirripedia*, Ray Society, London 1854, vol. 2.
[11] Francis Darwin (1848–1925).
[12] Charles Darwin : *A Monograph of the Fossil Balanidae and Verrucidae of Great Britain*, Palaeontographical Society, London 1854.
[13] Leonard Darwin (1850–1943).
[14] The preliminary work for the large book on natural selection.

1855. March & April employed chiefly in comparing seeds trying experiments in salting seeds & reading.

1856. May 14th Began by Lyell's advice writing Species Sketch
Oct 13 Finished 2nd Chapt (& before part of Geograph Distr.)
Dec. 16. 3rd Chapt.

1857. Jan. 26th Finished Ch. 4. Var: Nature.
March 3rd Find Ch. 5. Struggle for Existence.
March 31st Finished Ch. 6 Nat: Selection.
Septr 29th Finished Ch. 7 & 8 but one month lost at Moor Park.
Septr 30 to December 29th on Hybridism.

1858. March 9th finished instinct chapter.
April 14th Discussion on large genera & small & on Divergence & correcting Ch. 6. (Moor Park) finished June 12th & Bees cells.
June 14th Pigeons (interrupted)
July 20th to August 12th at Sandown began Abstract of Species book.[8]
Augt 17th recommenced Selection & Pigeon M.S.
Sept 16th Recommenced Abstract Sect. III & IV.
Octr 8 Began Sect V on Laws of Variation of Abstract finished 22d.
Octr 23rd Sect VI Difficulties finished.
Novr 13th Instinct (Moor Park).
,, 30th Hybridism.
Decr 11th Geological Succession.

1855. Jan 18 Went to 27 York Place, Baker St.[1] Feb. 15 Returned home.
Sep 10th Started for Glasgow. British Assocn Sleeping at Carlisle with Emma 19th return sleeping in Carlisle & reaching Shrewsbury on 20th & I returned home on 22nd.

1856. Sept 13th Leith Hill returned 19th.
November At Sarah[2] died.
Dec 6 Charles Waring Darwin[3] born.

1857. April 22d Moor Park,[4] Returned May 6th. Did me astonishing good.
June 16th to Moor Park, returned on 30th Etty there.
On 27th went to Selborne. In latter part of September for about week Lenny had very intermittent pulse; but now Octr 6th seems quite well, latter part of Octr occasionally poorly. Novr 13th seems quite well.
Novr 5th–12th Moor Park.

1858. April 20th Moor Park returned May 4th.
Etty very ill.
June 28th Poor dear Baby[5] died.
July 9th to Hartfield, 16th to I of Wight, 17th to Sandown,[6] 27th Shanklin,[7] August 13th Home.
Octr 25th Moor Park. Returned Novr 1st.
Marianne Parker[9] died in July.

[1] 27 York Place, Baker Street, was a house which the Darwins took for a month. (*cf. E.D.* ii, p. 170.)
[2] Sarah Elizabeth Wedgwood (1778–1856), sister of Josiah Wedgwood II.
[3] Charles Waring Darwin (1856–1858).
[4] Moor Park, Hydropathic establishment in Surrey.
[5] Charles Waring Darwin.
[6] The Darwins stayed at the King's Head Hotel, Sandown. (*cf. L. & L.*, ii, p. 129.)
[7] The Darwins stayed at Norfolk House, Shanklin. (*cf. L. & L.*, ii, p. 131.)
[8] *On the Origin of Species.*
[9] Darwin's eldest sister.

1859. Jan. 15 Abstract Geolog: Distr.
Feb. 28 Affinities & Classification.
March 19 Began relooking over first MS. Ch^s. & finished last Chapter.
May 25^th Began Proof sheets.
Oct. 1 Finished proofs. 13 months & 10 days on Abstract of Origin of Species. 1250 copies printed.
During end of November and beginning of December employed in correcting for 2^nd Edition of 3000 copies.
Multitude of Letters.
The 1^st Edit^n was published on Nov^r 24^th & all copies i.e. 1250 sold first day.

1859. Medal from Geolog. Soc:[1]
Feb. 5^th 19^th Moor Park did not do me so much good as usual.
May 21^st–28^th Moor Park.
July 19^th–26^th Moor Park.
Aug 20–23 Leith Hill.
Oct^r 2^nd Started for Ilkley.[2] Returned Home (staying in London two days) on Dec. 9^th.

1860. Jan. 9^th Began looking over MS. for work on Variation (with many interruptions). Letters & preparation for foreign edition on Variation.
March 24^th Began Introduction to Vol.
June 10^th Finished 2^nd Ch. on Pigeons arranged paper for next Ch. & experiments.
August 11^th Began Ch. III. During July at Hartfield & afterwards at Eastbourne worked at Drosera.

1860. Jan. Murray says 6000 Copies of my Journal now sold.
Jan^y 7^th The 2^nd Edition 3000 copies of Origin was published.
May 22. The 1^st Edit. of Origin in U. States was 2500 copies.
June 28^th to July 7^th Sudbrooke Park.[3]
July 10^th to Aug^t 2^nd Hartfield (Etty long ill).
Sept. 22 to Eastbourne.[4] Returned Nov^r 10^th seven weeks owing to Etty's illness.

	£
May 28^th 1^st Edit.	180
July & Oct 2^nd Edit.	636.13.4
May American Edit.	21.17.6
,, (61) ditto 1861	10.10
1861 April 30. 3^d Edit.	372.

1861. March 20^th Finished Ch. III on Variation under Domestication & began Ch. IV.
In Dec. last & Jan. prepared new & Third Edition of Origin: 2000 Copies.
May 16. Finished Fowls (8 weeks)
,, 31. Ducks.
July 1. During stay at Torquay did paper on Orchids. All rest of year Orchid Book.

1861. The new Edit. of Origin 2000 Copies was published in April.
July 1. Started for Torquay[5] & returned Aug^t 27^th, 8 weeks & a day.

1862. April 28 finished Orchis Book. Besides odd time for several years

1862. Feb. March & April. Horace[6] ill.

[1] Darwin was awarded the Wollaston Medal by the Geological Society on 18 February 1859. Sir Charles Lyell received it on his behalf.
[2] Wells Terrace, Ilkley: water-cure establishment. (*cf. L. & L.*, ii, p. 218.)
[3] Sudbrooke Park, Richmond, Dr Lane's water-cure establishment. (*cf. M.L.*, i, p. 158.)
[4] The Darwins took 15 Marine Parade, Eastbourne, for 9 weeks in September 1860.
[5] The Darwins stayed at 2, Hesketh Crescent, Torquay. (*cf. M.L.*, i, p. 190.)
[6] Horace Darwin (1851–1928).

—(*contd.*)

this book has cost me 9 months if I do not count Torquay, but in this time I did Primula Paper.[3] 2nd Edit (German) of Origin & experiments say 10 months counting ½ Time at Torquay.

May 15th Orchid Book[4] published. Much time wasted June & July from Leonard's illness. Finished Silk worms, geese &c.

Oct^{r} 7th Facts of Varieties of Plants.

Dec. 11th finished long chapter. Paper on Linum.[5]

Dec. 21. Bud variation.

1863. Jan. 23 Chapter on Inheritance, finished April 1st took me 6½ weeks, time lost by illness & London.

April 1 Chapter on Crossing and Sterility finished June 16th took me 8 weeks; time lost by Hartfield & Illness &c.

June 16th Selection, July 20th finished.

1864. Began to count seeds of Lythrum about April 20th. Finished Lythrum paper[7] about May 25th. Began Tendril paper[8] & finished it on Sept^{r} 13th but afterwards had about a fortnight for additions. Hence this paper on climbing plants took 4 months!!

Sep. 14. Began Laws of Variation for "Domestic Animals & Cult: Plants" & finished this Ch. on Nov^{r} 16th. I then began going over again the earlier chapter of Book on "Domestic Animals &c."

May 15th to 22nd Leith Hill Place.

June July August Leonard very ill Scarlet Fever.

Aug^{t} 12th to Southampton.[1]

Emma Scarlet Fever.

Sept^{r} 1 to Bournemouth.[2]

Sept^{r} 30 Home.

1863. Feb. 4th to 14th Stayed with Erasmus.

April 13th sick

April 20th Dr Jenner[6]

April 22nd Dr Jenner.

April 27th to May 13th Hartfield & Leith Hill Place.

Sept^{r} 2nd Malvern Wells; returned Oct 14th Ill then. Ill to end of year.

1864. Ill all Jan. Feb: March, Last sickness April 13th.

Aug^{t} 25. to Elizabeth for one week to Chester Place.[9]

The severe illness lasted seven months.

Copley Medal.[10]

[1] The Darwins stayed at 1, Carlton Terrace, Southampton. (*cf. M.L.*, i, p. 203.)

[2] The Darwins stayed at Cliff Cottage, Bournemouth. (*cf. M.L.*, i, 204.)

[3] Charles Darwin: "On the two forms of dimorphic condition in the species *Primula*, and their remarkable sexual relations", *J. Linn. Soc. Lond.*, (*Bot.*), vol. 6, 1862, p. 77.

[4] Charles Darwin: *On the various contrivances by which Orchids are fertilized by insects*, London 1862.

[5] Charles Darwin: "On the existence of two forms, and on their reciprocal sexual relation, in several species of the genus Linum", *J. Linn. Soc. Lond.*, (*Bot.*), vol. 7, 1864, p. 69.

[6] Probably Sir William Jenner (1815–1898), physician to University College Hospital.

[7] Charles Darwin: "On the sexual relations of the three forms of *Lythrum salicaria*", *J. Linn. Soc. Lond.*, (*Bot.*), vol. 8, 1865, p. 169.

[8] Charles Darwin: "On the movements and habits of climbing plants", *J. Linn. Soc. Lond.*, (*Bot.*), vol. 9, 1867, p. 1.

[9] 4, Chester Place, Regent's Park, home of Sarah Elizabeth Wedgwood (1793–1880).

[10] The Copley Medal of the Royal Society was presented to Darwin 30 November 1864 "for his important researches in Geology, Zoology and Botanical physiology".

1865. Jan. 1. I continued on "Domestic Animals &c" Ch X till April 22nd when (with exception of one week) I became ill & remained so & unable to do anything (except read Origin for 2nd French Edit.) till early in Dec. when I began correcting Homomorphic seeds.

On Dec. 25. began again on Chapt. X of Domestic Animals.

1866. Continued correcting Chaps of Domestic Animals.

March 1st Began on 4th Edit of Origin of 1250 Copies: (Received for it 238 £) making 7500 copies altogether.

May 10th Finished Origin except Revises & began going over Ch. XIII of Dom Animals.

Novr 21. Finished Pangenesis.

Dec. 21. Finished regoing over all Chapters, & sent them to Printers.

Dec. 22. Began concluding chapter of Book.

1867. Last chapt of "Variation under Domestication" & beginning of Man Essay. First proof arrived March 1st. Revises finished Nov. 15th. I began this book beginning of 1860 (& then had some MS.), but owing to interruptions from my illness & illness of children, from various editions of Origin & papers especially Orchid book & Tendrils I have spent 4 years & 2 months over it—1260 Copies sold at Murray Sale.

The Book not actually published until Jan. 30 1868.

1868. New Book on Var. under Domestication[3] published on Jan. 30 (1500 cops). On Feb 10th a new edition to be printed of 1250 Copies. Received for this edition 720 £.

Began middle of December 1867 On illegitimate Offspring of Dimorphic

1865. Fell ill on April 22nd, got a little better in middle of Septr.

On Nov. 8th went to Erasmus & staid ten days & fell ill again with cold, but got better in beginning of December.

1866. April 21st to May 2nd to Erasmus.

May 29th to June 2nd Leith Hill Place.

Novr 22nd to 29th to Erasmus.

Febv. 2 Catharine[1] died.

Octr 3 Susan[2] died.

1867. Feb. 13 to 21 to Erasmus.

June 17 to 24 ditto

Sept 18 to 24 ditto poorly all time.

Novr 28 to Dec. ditto very well.

1868. March 3 for a week to Erasmus[4] & then for 3 weeks to Aunt Elizabeth's House.[5] Returned home April 1st.

June 23rd unwell & continued so to July 16th & did hardly anything.

July 16th to Isle of Wight (Freshwater).[6]

[1] Emily Catherine Langton née Darwin (1810–1866), wife of Charles Langton and Darwin's youngest sister.

[2] Susan Elizabeth Darwin (1803–1866), Darwin's sister.

[3] Charles Darwin: *The Variation of Animals and Plants under Domestication.* London 1868.

[4] Erasmus Darwin was living at 6, Queen Anne Street, Cavendish Square. (*cf. M.L.*, ii, p. 66.)

[5] 4, Chester Place, Regent's Park (*cf. M.L.*, ii, p. 68.)

[6] At Mrs. Cameron's house, Dumbola Lodge, Freshwater, Isle of Wight, which the Darwins took for 6 weeks, Darwin was visited by Tennyson, Longfellow, and Thomas Appleton. Mrs. Cameron, née Pattle, was the sister of Mrs. Prinsep and Lady Somers. (*cf. E.D.*, ii, p. 220.)

1868—(*contd.*)

& Trimorphic Plants & on specific difference of Primula[1] & finished Feb. 1.

Feb. 4th Began on Man & Sexual Selection.

May 17th Birds—Sexual Selection.

Decr 26th Fifth Edition of Origin Edit. of 2000 Copies.

1869. Feb. 10th Finished 5th Edit of Origin[2] has taken me 46 days.

Feb. 11th Sexual Selection of Mammals & Man & Preliminary Chapter on sexual Selection (with 10 days for notes on Orchids) to June 10th when I went to North Wales.

On Augt 4 recommenced going over all chapters on Sexual Selection.

1870. I find Murray has printed 9000 copies of my Journal of Travels & Colburn[3] 1500 = 10,500 copies.

The whole of the year at work on the Descent of Man & Selection in relation to Sex. I began this work on Feb. 4th 1868 but many interruptions. Went to press Augt 30 & finished last proof.

1871. I began "Descent of Man & S. Selection" on Febv 4th 1868. & I have now Jan 15th corrected last sheet; so it has taken me nearly 3 years, but the 5th Edit. of Origin took up 46 days & notes on Orchids 10 days; & health compelled many visits & rests.

Descent of Man published Feb. 24th. At first 2500 copies printed & 2000 reprinted. Received 1470£.

Jan 17. Began Expression & finished final rough copy on April 27. Many interruptions.

June 18th Began 6th Edit. of Origin;

Aug 21st Returned to Down having slept at Southampton.

Novr 7th–16th Erasmus.

1869. Feb. 16th 24th to Erasmus.

June 10th started for Caerdeon, Barmouth sleeping at Shrewsbury. Returned July 31st having slept at Stafford.

Weak & unwell.

Novr 1st to 9th Erasmus.

1870. March 5–10 Erasmus.

May 20–24 Cambridge.[4]

June 24 to July 1. Erasmus.

Augt 13–26 Southampton at William's.[5]

Oct 13–20 Leith Hill & I wrote.

Dec. 8–14 Erasmus.

1871. Feb. 23 to March 2nd Erasmus.

April 1 to 5 ditto

May 11–19 Southampton.

June 24–30 Erasmus.

July 28 Haredene Albury,[6] Home Aug 25.

Aug 31. Henrietta[7] married.

Nov. 3–10 Leith Hill Place.

Dec. 12–22 Erasmus.

[1] Charles Darwin: "On the character and hybrid-like nature of the offspring from the illegitimate unions of dimorphic and trimorphic plants", *J. Linn. Soc. Lond.*, (*Bot.*), vol. 10. 1869, p. 393.

[2] Published June 1869.

[3] Henry Colburn published the first edition of the *Journal of Researches*. London 1839.

[4] Darwin stayed at the Bull Hotel, Cambridge.

[5] Bassett, Southampton, home of William Erasmus Darwin (1839–1914), Darwin's eldest son, partner in a Bank in Southampton.

[6] Haredene, Albury, near Guildford was a house which the Darwins took for a month. (*cf. E.D.*, ii, p. 245.)

[7] Henrietta Emma Darwin, Darwin's daughter, married Richard Buckley Litchfield (1832–1903).

1871—(*contd.*)

Oct 29th finished MS. but lost 2 months by illness.

Nov. & Dec. Proofs of ditto & Expression &c. & illness & visits.

1872. Jan 10th Finished Proofs of Origin & again rewriting expression.

Augt 22. Finished last Proofs of Expression[2] which I began on Jan 17th last year. (Has taken me about 12 months).

Augt 23rd Began working at Drosera.

Nov. 3rd Began writing on ditto.

Novr 8th At Murrays Sale 5267 Copies of Expression Book sold to London Booksellers. The Edition consists of 7000 published November, 2000 at end of year additional.

1873. Jan 15 Finished Drosera 14th & recorrected climbing plants.

Feb. 3 Began on evil [*sic*] effects of inter-crossing.

June 14th Began Drosera again.

Oct. 20 Began correcting Drosera MS.

Nov. 20 Began correcting 2nd Edit of Descent of Man, & continued for rest of year & next year.

1874. Second Edit. of Descent and of Coral Reefs. The Descent took 3 months.

April 1. Began Insectivorous plants —(interruptions from Proof sheets) & went on whole rest of year, writing & some observations.

1875. March 29th finished MS. of Insectivorous & recorrecting climbing Plants.[8]

1872. Feb. 13 to March 21. London, 9 Devonshire St. Portland Place[1] (5 weeks).

June 8–20 Southampton.

Augt 13 to 21 Leith Hill Place.

Oct 5 to 26 Sevenoaks Common.[3]

Decr 17 to 23 Erasmus (unwell all time).

1873. March 15th to April 10th at 16 Montague St.[4]

June 4th to 12th Leith Hill Place

Augt 5th to 9th at Abinger,[5] from 9th to 21st at Basset.

Nov. 8–18th Bryanston St[6] (very pleasant).

1874. Jan 10th to 17th Erasmus.

Apl 21st to 29th Henrietta.

July 25th to Abinger, 30 to William.

Augt 24th to Home.

Decr 3rd–12 Henrietta's.

Frank[7] married July.

Copies sold in Germany of Translation Feb. 1. 1874 Origin 6500, Descent of Man 5000, Var. 1700, Expression 3000, Orchids 600.

1875. March 31st to Eras: & Litchfields, Home April 12th.

June 3rd to July 5th Abinger Hall.

[1] 9, Devonshire Street, Portland Place, was a house which the Darwins took for a month. (*cf. E.D.*, ii, p. 254.)

[2] Charles Darwin: *The Expression of Emotions in Man and Animals.* London 1872.

[3] Horace Darwin had lodgings at Sevenoaks.

[4] 16, Montague Street, was a house which the Darwins took for a month. (*cf. E.D.*, ii, p. 262.)

[5] Abinger Hall, home of Sir Thomas Henry Farrer, afterwards Lord Farrer, married firstly Cecilia Erskine; and secondly Katherine Euphemia Wedgwood, Darwin's wife's niece.

[6] 4, Bryanston Street, home of Henrietta Emma Litchfield.

[7] Francis Darwin married Amy Richenda Ruck.

[8] Charles Darwin: *The Movements and Habits of Climbing Plants.* London 1875.

1875—(*contd.*)

Began correcting 3rd June

Began writing with some observations on April 1st on Insectivorous Plants.

July 2nd Insectivorous Plants published. 2700 sold immediately.

July 6th Correcting 2nd Edit. of Var. under Domestication.

Oct 3rd Finished about Var under Domestication but shall have nearly month of more work with proofs &. Therefore I may say I began " On advantages of Crossing " on Septr 1st.

1876. May 5 Finished MS. first time over of effects of Cross Fertilization. Began correcting 2nd Editn of Orchid Book, much labour, at Hopedene began my little Autobiography.

June 11th Began going over for 2nd time MS. of effects of Cross Fertilisation.

Augt 19th Firs proofs of ditto.

Oct 21st Finished proofs. Published[3] on Novr 0th & 1500 copies sold by end of year. In intervals I worked at 2nd Edit. of Orchids. Novr 14 finished first proof—published at end of year.

Nov 15th Began on Heterostyled Plants but in intervals I have done 2 or 3 weeks work say Nov. 1st I began on the book so during last 14 months I have done Effects of Cross Fertilisation & 2nd Edit. of Orchids; but then I had rough MS. written out of the experimental parts of " the Effect &c ".

1877. All the early part of Summer at work on " Different forms of Flowers " published (1250 copies) middle of July.

From that time to end of year working on Bloom Spontaneous Movement of Plants & Heliotropism & a little on Worms.

July 2nd Insectivorous Plants published. 3000 Copies printed.

Augt 28th to Sept 11th Southampton, William.

Nov. 4th & 5th Erasmus, Vivisection Commission.

Dec. 10th to 20th Bryanston St.

1876. Feb. 3rd–5th at Erasmus.
Apl 27th to May 3 ditto.
May 24th to Hopedene.[1]
June 7 Hollycombe.[2]
,, 10th Home.
Oct 4th Leith Hill.
,, 7th Southampton.
,, 20th Home.
Septa 11 Poor Amy[4] died, a most dreadful blow to us all.

1877. Jan 6 to 15 Henrietta.
April 12 to 28 ditto & Erasmus.
June 8th Leith Hill, 13th to Southampton, Stonehenge & returned home July 4th.
Augt 20–25. Abinger, delightful.
Oct 26–29. Erasmus.
Nov. 16–19 Cambridge, LL.D. Degree.[5]

[1] Hopedene, Surrey, home of Hensley Wedgwood (1803–1891), Darwin's wife's brother.

[2] Hollycombe, near Midhurst, Sussex, home of Sir John Hawkshaw (1811–1891) whose son John Clarke Hawkshaw (1841–1921) married Cecily Mary Wedgwood (1837–1917) daughter of Francis Wedgwood (1800–1888) brother of Darwin's wife and son of Josiah Wedgwood II (1769–1843). Cecily Mary Hawkshaw's brother Godfrey Wedgwood (1833–1905) married Mary Hawkshaw as his first wife.

[3] Charles Darwin : *The Effects of Cross- and Self-fertilization in the Vegetable Kingdom*, London 1876.

[4] Amy, first wife of Francis Darwin.

[5] The degree of LL.D. was conferred on Darwin on 17 November, 1877.

1878. The whole of this last year on the circumnutating Movements of plants & bloom.

1879. The whole of this year on circumnutating movements of plants except about 6 weeks on Life of Erasmus Darwin.

1880. Circumnutating Movements. All Spring publishing MS. of " Power of Movement in Plants " & then Proof Sheets—Began in Autumn on Worms.
Novr 6th 1500 Copies of Power of Movement sold at Murrays Sale.

1881. All early part of year Worm book[7] published Oct: 10th 2000 Copies sold immediately, 5000 printed by December & corrected a new Edit. November on the action of C. of ammonia on Chlorophyll & on roots of Euphorbia & other plants.

[1882
April 17 Recorded an experiment for Francis Darwin.]

1878. Jan. 17–23 at Erasmus.
Feb. 27 to March 5. Bryanston St on account of Giddiness.
April 27 to May 13th Southampton.
Augt 7th Leith Hill, Abinger, & Barlaston[1] Home Augt 22nd.
Nov. 19–27th Bryanston St.

1879. Febv 27 to March 5 at Erasmus on account of Elizabeth's illness.
May 6th Worthing. 8th Southampton. 21 Leith Hill 26th Home.
June 26th Erasmus, Baly Medal,[2] 28th Laura Forster.[3]
July 1. Home.
Augt 1 to 27 Coniston sleeping at Erasmus.
Decr 2nd to 11th Henrietta & Erasmus.

1880. March 4th–8th Erasmus.
April 8–13 Abinger, Horace & Ida.[4]
May 25 to June 8 Southampton.
Augt 14th to Cambridge,[5] 19th Erasmus, 21st Home.
Oct 20 to Novr 2nd Henrietta's House.
Nov. 8th Eliz: Wedgwood[6] died.
Decr 7 Erasmus. 11th Leith Hill Place. 15th Home.

1881. Feb. 24th to March 3rd Bryanston St
June 2nd to July 4th Patterdale.[8]
August 3rd to 5th to Erasmus.
,, 26th Erasmus[9] died at night.
Sept. 8th to 10th to A. Rich Worthing.[10]
Oct 20–27 at Horace's at Cambridge.
Decr 13th to 20th Bryanston St.

[1882
March 7 Suffered seizure on his last visit to ' Sand Walk '.
April 19 Darwin died at Down.
April 26. Buried in Westminster Abbey.]

[1] Barlaston, Staffordshire, home of Francis Wedgwood (1800–1888), Darwin's wife's brother.
[2] The Baly Medal of the Royal College of Physicians.
[3] Laura May Forster (1839–1924), of West Hackhurst, Abinger Hammer, Dorking, lent her house to the Darwins to minimize the fatigue caused by this journey to London. (*cf. L. & L.*, iii, 224, and E. M. Forster: *Marianne Thornton*, London 1956.)
[4] Emma Cecilia Farrer (Ida) married Horace Darwin in 1880.
[5] The Darwins were visiting the Horace Darwins at Botolph Lane, Cambridge. (*cf. E.D.*, ii, 306.)
[6] Sarah Elizabeth Wedgwood (1793–1880), eldest sister of Darwin's wife.
[7] Charles Darwin: *The formation of vegetable mould through the action of worms, with observations on their habits*. London, 1881.
[8] The Darwins took Glenrhydding House, Patterdale for a month. (*cf. M.L.*, ii, p. 433.)
[9] Erasmus Alvey Darwin (1804–1881), Darwin's brother.
[10] Anthony Rich, of Heene, Worthing. (*cf. E.D.*, ii, p. 291.)

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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by

SIR GAVIN DE BEER

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES PART I. FIRST NOTEBOOK (JULY 1837—FEBRUARY 1838)

Edited with an Introduction and Notes

BY

SIR GAVIN DE BEER

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PART I. FIRST NOTEBOOK (JULY 1837–FEBRUARY 1838)

INTRODUCTION

IN Darwin's *Journal*[1] the year 1837 contains an entry which runs, " In July opened first notebook on ' Transmutation of Species '—Had been greatly struck from about month of previous March on character of S. American fossils—& species on Galapagos Archipelago. These facts origin (especially latter) of all my views." This notebook is transcribed and printed below and forms the subject of the present study.

The four Notebooks on Transmutation of Species are the first implementation of the suggestion put forward by Darwin in his Ornithological Notebook[2] referring to his visit to the Galapagos Islands in September and October 1835. There he wrote :—" When I recollect the fact, that from the form of body, shape of scale and general size, the Spaniards can at once pronounce from which Isd. any tortoise may have been brought :—When I see these Islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds but slightly different in structure and filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware is the constant asserted difference between the Wolf-like Fox of East and West Falkland Islands.—If there is the slightest foundation for these remarks, the Zoology of Archipelagoes will be well worth examining ; for such facts would undermine the stability of species ".

The First Notebook, begun in July 1837, represents the state of Darwin's opinion as it developed six months after his return to England, the results of his consulting the literature on the subject, and the first formulation of his conviction that the stability of species had been " undermined ".

It will be noticed that the passage from the *Journal* quoted above must have been a retrospective entry written at a later date, for if he only began his Notebook in July 1837 he could not then have known what " all his views " were. In this First Notebook itself Darwin stated that he finished it " probably " in February 1838,

[1] " Darwin's Journal ", edited by Sir Gavin de Beer, *Bull. Brit. Mus.* (*Nat. Hist.*) Historical Series, vol. 2, p. 1, 1959.

[2] *Charles Darwin and the Voyage of the Beagle*, edited by Nora Barlow, London 1945, p. 246. It is not known at what exact date these words were written.

and this was nine months before he read Malthus's *Essay on Population* which, as he said[1] (and Wallace also admitted[2] in his own case) supplied him with the remaining piece that he required to complete the construction of his argument. What that argument was is known from Darwin's[3] *Sketch* of 1842 and *Essay* of 1844, from which the *Origin of Species* was elaborated without much novelty of principle.

The First Notebook is therefore of great importance in tracing the course of his thoughts and the extent of his knowledge before his cognisance of Malthus's work, and will throw light on what it was in the latter which gave Darwin that extra idea which acted as a spark and launched him on his course.

At the outset, however, it must be made clear that the Notebooks all suffer from a grave defect. In the First Notebook Darwin himself wrote on the first page[4]: " All useful pages cut out. December 7, 1856. (and again looked through April 29, 1873)." In spite of all attempts to trace the missing fifty pages, in the Cambridge University Library where Mr P. J. Gautrey searched for them, at Down House and the Royal College of Surgeons where Miss J. Dobson looked for them, and in the British Museum (Natural History) where Miss M. Skramovsky hunted for them among the letters addressed to Darwin deposited by Mr Robin Darwin, they could not be found. The nature of their contents can only be surmised after a close study of the two hundred and thirty pages that remain, and an estimate can be made of what is missing from the information and the argument.

Another reason why the Notebooks are important is because Darwin has from time to time been reproached for having obtained information from the writings of other men without acknowledging the source. The *Origin of Species*, as is well known, contains the names of Darwin's authorities for the facts stated, but not their bibliographical references, for Darwin regarded his book as only an abstract from the much larger work on which he was then engaged but never finished. The *Sketch* of 1842 and the *Essay* of 1844, likewise, contain names without bibliographical references, but they were written only as an exercise in reviewing the state of his own argument and not intended for publication. The Notebooks, as will be seen, contain names and references.

Before any conclusion can be drawn on Darwin's indebtedness to his predecessors three considerations must be borne in mind. The first is the precise identification of what the original contribution to science was which Darwin himself claimed to have made. This is known from a letter[5] which he sent on 18th January 1860 to Baden Powell. " No educated person ", he wrote, " not even the most ignorant, could suppose that I meant to arrogate to myself the origination of the doctrine that species had not been independently created. The only novelty in my work is the attempt to explain *how* species became modified, & to a certain extent how the

[1] *The Autobiography of Charles Darwin*, edited by Nora Barlow, London 1958, p. 120.

[2] Alfred Russel Wallace, " Note on the passages of Malthus's ' Principles of Population ' which suggested the idea of natural selection to Darwin and myself." *The Darwin and Wallace Celebration held on Thursday, 1 July 1908 by the Linnean Society of London*, London 1908, pp. 111–118 ; especially p. 117.

[3] Darwin's *Sketch* of 1842, and *Essay* of 1844 are reprinted in Charles Darwin and Alfred Russel Wallace : *Evolution by Natural Selection* with a Foreword by Sir Gavin de Beer, Cambridge 1958.

[4] All page references to Darwin's Notebooks on transmutation of species are to the pagination of the original manuscripts indicated in the margin of the transcription printed below.

[5] " Some unpublished letters of Charles Darwin ", edited by Sir Gavin de Beer, *Notes and Records of the Royal Society of London*, vol. 14, 1959, p. 52.

theory of descent explains certain large classes of facts; & in these respects I received no assistance from my predecessors."

In arriving at a just appraisal of Darwin's character, this quoted passage is very important, and his contention is correct. Some of his predecessors, as will be seen, acknowledged evolution but had no notion of any mechanism adequate to explain its cause, let alone any idea of natural selection; two contemporaries[1] recognized natural selection but used it to prove that evolution could not occur. Unknown to Darwin, two other men[2] had, before him, grasped the solution of the problem and stated that natural selection could cause modification of species; but they were very far from being able to appreciate the significance of what they had done, provide evidence to support it, or work out its consequences.

The second consideration to bear in mind is that while Darwin was always on the look-out for facts, what he most hoped for in the works of his predecessors and contemporaries was ideas.

The third consideration is the necessity of appreciating what information and opinions, correct and false, were available in 1837 when Darwin "opened" his Notebook. Chief among these was the folk-belief in the inheritance of acquired characters. As Conway Zirkle has shown,[3] this is based on an uncritical combination of two propositions each of which by itself is approximately correct. The first is that organisms can be changed, often in an adaptive manner, by the conditions of the environment. The blacksmith's muscles are enlarged as a result of wielding his hammer. The second proposition is that organisms tend to produce offspring like themselves not only in physical features but in functional characters like gait and voice. Hence the conclusion is drawn that parents modified by the environment will produce offspring showing the same modifications.

This syllogism is invalidated because its middle term (resemblance between parent and offspring) is not only undistributed, but, as modern genetics has proved, fallacious. Offspring are not the product of their parents, but of germ-cells of which the parents are only the life-custodians. The old block produces no chip but is the elder brother, and the chip resembles him, if he does, because both are the product of the same line of germ-plasm.

The old wives' tale of the hereditary effect of environmentally evoked modifications or inheritance of acquired characters is deeply built-in to folk lore. It appears in one of the earliest Greek myths. When Phaethon drove his father Apollo's chariot across the sky, the horses got out of control and carried the sun much too near Abyssinia with the result that the Ethiopians' skins were scorched black, and their offspring became the negroes.

In the form of hereditary transmission of maternal impressions, it also appears in the Old Testament.[4] Jacob when working for Laban agreed that he could not have any white sheep or unspotted goats, but if any lambs were born brown or any goats spotted and speckled, he might have them for himself. Jacob thereupon

[1] Charles Lyell and Edward Blyth.
[2] William Charles Wells and Patrick Matthew.
[3] Conway Zirkle. "The early history of the idea of the inheritance of acquired characters and of pangenesis", *Trans. Amer. Phil. Soc.*, vol. 35, 1946, p. 91.
[4] *Genesis*, 30, 30–42.

selected the strongest animals and presented to their eyes striped patterns of green leaves and white rods just before they conceived, with the result that they " brought forth cattle ringstraked, speckled, and spotted " which therefore belonged to Jacob ; the weaker, untreated animals produced offspring which remained true to the specification of Laban's property.

In the revival of science in the 18th century, Maupertuis, Diderot, Buffon, Erasmus Darwin, and Lamarck accepted the hereditary transmission of environmentally induced modifications as a matter of course.[1] It would never have occurred to them, or to Darwin, to doubt it. Nor would it have occurred to Darwin that in making use of this notion he was in any way indebted to Lamarck. In all the history of science before 1800 only three names stand out in opposition to the old fallacy : Lucretius, because he believed in particulate inheritance with " atoms " of inheritance derived from previous generations ; Charles Bonnet, whose theory of *emboitement* of all future generations within the parent involved predetermination which could not admit of modification ; and Immanuel Kant, who repudiated it because otherwise evolution would have occurred, and he believed that it had not.

As Loren Eiseley[2] has remarked, it only remains to underline the irony with which this fallacy has been identified with the name of Lamarck who did not invent it. The term " Lamarckism " should in all justice be applied to evolution itself, since he was the first to advocate it as a co-ordinated system.

Belief in the inheritance of acquired characters was a consequence of the total ignorance of the nature of hereditary transmission. For incontrovertible experimental knowledge of this process, science had to wait not only for Gregor Mendel to publish his results in 1866, but for scientists to rediscover them in 1900 ; for T. H. Morgan and his colleagues to extend them and correlate them with the results of research in chromosome cytology, developed to a marvellous degree by C. Stern and C. D. Darlington ; and for Sir Ronald Fisher[3] to produce his great synthesis in 1930, wherein he demonstrated that the mechanism of particulate inheritance of Mendelian genes which remain uncontaminated, segregate, recombine, self-copy, and occasionally mutate, provides exactly what Darwinian selection theory requires to explain the source of variation ; that Selection provides exactly what Mendelian theory requires to explain why some genes become dominant, others recessive, and others again suppressed ; and that no mechanism other than selection will explain all the facts.[4]

In Darwin's day there was nothing to go on at all except the age-old belief that like tends to beget like, and that when parents differed their offspring represented an average between them. This view is referred to as " blending inheritance ", and it permeates Darwin's work and caused him the greatest trouble since it supposed that variance was halved at each generation and obliterated in ten generations, which therefore made it so difficult to account for the necessary supply of variation.

It is not easy today to realize the difficulty presented in Darwin's time by the

[1] Jean Rostand. *L'évolution des espèces*, Paris 1932, and *L'atomisme en biologie*, Paris 1956.
[2] Loren Eiseley. *Darwin's Century*, London 1959, p. 204.
[3] R. A. Fisher. *The Genetical Theory of Selection*, Oxford 1930.
[4] R. A. Fisher. " The bearing of genetics on the theory of evolution ", *Science Progress*, vol. 27, 1932, p. 15.

extinction of species. To admit that species of plants or animals could become extinct involved the admission that the protection of divine providence had been withheld from such species, and a considerable part of Darwin's early work was devoted to this problem, which was really a necessary corollary to the view that species were mutable. If in accordance with the hypothesis of mutability species split and gave rise to other species, the problem of the disposal of old obsolete species necessarily arose, and its solution by accepting the fact of extinction was not only an inevitable conclusion, but a help to Darwin in explaining why the gaps between some species were larger than those between others.

There was another fallacy which obstructed the progress of biological science, especially in Great Britain during the twenties and thirties of the nineteenth century, namely the quinarian theory[1] associated with the name of William Sharp MacLeay. This was the mystical system of classification built on the supposition that at all levels the animal kingdom is based on five groups arranged in a circle, each with affinities to its neighbours on both sides, each containing five sub-groups arranged in a comparable manner with affinities to their neighbours, and so on. According to MacLeay, " There are five great circular groups in the animal kingdom which possess each a peculiar structure," and " these, when connected by means of five smaller osculant groups, compose the whole province of zoology."[2] In the Crustacean circle, itself one of the five groups of the Annulosa, the Decapoda " have relations of analogy " with the Araneidea of the Arachnid circle while the latter's Acaridea have " relations of analogy " with the Diptera of the neighbouring insect circle.

Presently, Edward Newman improved on MacLeay's quinarian system by substituting the number 7 for 5 because of the 7th day of Creation, etc. " Most groups of animals with which we are tolerably well acquainted are divisible into seven ; we shall never find the number greater, and when less, we shall invariably perceive that the deficiency exists in groups of which our knowledge is particularly limited."[3]

There would be no need to make mention of such abject nonsense were it not for the fact that at the time when Darwin opened his Notebook these notions were current, and, as will be seen, (pp. 46, 129), Darwin himself had to struggle through them when considering the problem of affinities between different groups.

Next, it will be profitable to consider the legacies of Darwin's immediate predecessors and the contributions of his contemporaries that were known to him. First comes Erasmus Darwin.[4]

Erasmus Darwin believed in the transmutation of species and evolution because of the observed changes undergone by organisms during their life-history, the changes brought about by domestication and resulting from hybridization, and monstrous

[1] William Sharp MacLeay. *Horae entomologicae*, London 1819–21. The Quinarian System was also adopted by William Swainson : *The natural history and classification of birds, Lardner's Cabinet Cyclopaedia*, London 1837, vol. 2, pp. 56 and 100.

[2] MacLeay. *op. cit.* p. 318.

[3] Edward Newman. *Sphinx vespiformis* : *an essay*, London 1832, p. 15. Since nature possesses the tendency for the formation of globes or circles (e.g. the sun and its planets), he agrees with the principle of MacLeay's quinarian system, but substitutes the number 7 for 5, because God rested on the 7th day, Noah took 7 clean animals into the ark, there were 7 plagues, 7 years of famine, 7 years of plenty, 7 golden candlesticks, 7 churches, 7 angels, 7 spirits of God.

[4] Erasmus Darwin. *Zoonomia* ; *or, the laws of organic life*, vol. 1, London 1794.

births. He was aware of the general similarity of structure shown by vertebrate animals, and he believed that the modification of species was brought about by the satisfaction of wants for " lust, hunger, and danger ",[1] and as a result of " their own exertions in consequence of their desires and aversions, of their pleasures and pains, or of irritations, or of associations ; and many of those acquired forms or propensities are transmitted to their posterity."[2] He therefore accepted the inheritance of acquired characters.

In his work, an astonishing number of principles can be found which echo later developments in Darwin's hands. Adaptation, protective colouration, the struggle for existence, artificial selection, sexual selection, vestigial organs, the importance of cross-fertilization, the significance of monsters as proof against preformation in primordial germs, and the occurrence of mutations such as polydactylous cats and rumpless fowls, are all touched on. But when Erasmus Darwin ascribed the production of adaptation to " the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations ; and thus possessing the faculties of continuing to improve by its own inherent activity, and of delivering down those improvements to its posterity, world without end ",[3] a " power working from within ", and " internal impulse ", or a " living force ," it is easy to see why such a hard-headed scientist as Darwin should have been " much disappointed, the proportion of speculation being so large to the facts given " in the work of his grandfather.

One observation Darwin did cull from Erasmus Darwin's *Zoonomia*, as the First Notebook shows (p. 1), namely that sexual reproduction is conducive to variation, whereas asexual reproduction allows of none.[4] This fact, which has no direct bearing on Erasmus Darwin's views on evolution, became the basis of Darwin's views on the supply of variation.

Lamarck[5] believed in the mutability of species because of the difficulty of distinguishing between species and varieties,[6] and having with a stroke of genius substituted for the old static scale of beings a dynamic branching tree,[7] his was the first scientific formulation of the " transformism " of species, although he only assumed it as axiomatic and provided no evidence to support it. He was familiar with the fact of the struggle for existence[8] and the importance of adaptation ; he realized the vast amount of time required for evolution to have taken place, but appeared to think that species had not suffered extinction but had instead become transformed.[9]

Before proceeding to consider Lamarck's attempt to provide an explanation of

[1] Erasmus Darwin. *op. cit.* p. 503.
[2] Erasmus Darwin. *op. cit.* p. 503.
[3] Erasmus Darwin. *op. cit.* p. 505, cf. also p. 500 : " in the more advanced state of the fetus, it evidently possesses volition ; as it frequently changes its attitude, though it seems to sleep the greatest part of its time ; and afterwards the power of volition contributes to change or alter many parts of the body during its growth to manhood, by our early modes of exertion in the various departments of life."
[4] Erasmus Darwin. *op. cit.* p. 487.
[5] Jean Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809.
[6] Lamarck. *op. cit.* vol. 1, p. 73.
[7] Lamarck. *op. cit.* vol. 1, p. 76 : " une série rameuse."
[8] Lamarck. *op. cit.* vol. 1, p. 112.
[9] Lamarck. *op. cit.* vol. 1, p. 93.

the cause of " transformism "[1] or " evolution " as Lyell[2] termed it, there is a matter which calls for attention in the reasoning behind Lamarck's argument by which he reached the conclusion that transformism had occurred. It was based on the notion that the greater the number of species of a genus that were collected and studied, the more they appeared to grade insensibly into one another, with the result that taxonomic distinctions could not be made between them. If this were really so, systematic classification would be logically impossible. Using the expression of " species-barrier ", so happily coined by Professor Loren Eiseley,[3] it could be said that Lamarck did not discover the solution to the problem of how to penetrate it, but that he abolished it. As Sir Ronald Fisher has pointed out,[4] this criticism must not be applied to the solution found by Darwin of how the species-barrier could be penetrated, because Darwin was careful to recognize that species are well-defined even if their limiting characters are changeable.

Lamarck's explanation of the cause of transformism is contained in his four laws[5]:— 1. Life, by its own forces, tends continually to increase the volume of every body possessing it and to extend the dimensions of its parts, up to the limits which it sets itself. 2. The production of a new organ in an animal body results from the emergence of a new need which continues to make itself felt, and a new movement which this need evokes and maintains. 3. The development of organs and their power of action stand in constant relation to their use. 4. Everything that has been acquired, traced, or changed in the organization of individuals in the course of their life is preserved by generation and transmitted to the new individuals that descend from those which have experienced those changes.

The tendency to perfection[6] resulting from Lamarck's first Law necessitated an explanation of the persistence on earth of forms like infusoria which remain " imperfect ", and this he provided by supposing that spontaneous generation[7] had taken place continuously, and that the more " imperfect " an organism is, the more recently its stock was generated.

The " movements " from which the production of new organs is supposed to follow,

[1] The term " transformism " is preferred by many French-speaking authors (e.g. Alphonse de Candolle, *Darwin*, 2nd edition, Genève 1882, p. 35) because the successive changes are not always in the direction of increased development but may result in simplification. cf. also Jean Rostand. *L'état présent du transformisme*, Paris 1931, p. 13.

[2] Charles Lyell. *Principles of Geology*, London 1832. vol. 2, p. 11 which contains the first use in English of the term evolution in its present accepted sense.

[3] Eiseley. " Charles Darwin, Edward Blyth, and the theory of natural selection." *Proc. Amer. Phil. Soc.* vol. 103, 1959, p. 108.

[4] Sir Ronald Fisher. " Retrospect of the criticisms of the theory of natural selection ", *Evolution as a Process* edited by Julian Huxley, A. C. Hardy and E. B. Ford, London 1954, p. 88.

[5] Lamarck. *Histoire naturelle des animaux sans vertèbres*, Paris 1815, vol. 1, p. 181 : " 1ère loi. La vie, par ses propres forces, tend continuellement à accroître le volume de tout corps qui la possède, et à étendre les dimensions de ses parties, jusqu'à un terme qu'elle amène elle-même.

"2ième loi. La production d'un nouvel organe dans un corps animal, résulte d'un nouveau besoin survenu qui continue de se faire sentir, et d'un nouveau mouvement que ce besoin fait naître et entretient.

"3ième loi. Le développement des organes et leur force d'action sont constamment en raison de l'emploi de ces organes.

"4ième loi. Tout ce qui a été acquis, tracé ou changé, dans l'organisation des individus, pendant le cours de leur vie, est conservé par la génération, et transmis aux nouveaux individus qui proviennent de ceux qui ont éprouvé ces changemens."

[6] Lamarck. *Philosophie Zoologique*, vol. 1, p. 263.

[7] Lamarck. *Philosophie Zoologique*, vol. 1, p. 82 ; vol. 2, p. 78.

Lamarck contended are due to the *sentiment intérieur*,[1] or inner feeling possessed by " those animals which have a nervous system sufficiently developed to permit them to experience sensation. This feeling, although obscure, is very powerful for it is the source of the internal emotions experienced by those individuals that possess it, and therefore is the source of that curious force which places those individuals in a position to produce themselves the movements and actions which their needs demand ". Lamarck's attempts to define his *sentiment intérieur* were not felicitous. In one place he wrote[2] of " the emotions of the inner feeling which actuate animals and man himself, sometimes without any participation of the will, sometimes by an act of volition that gives rise to it." Elsewhere,[3] the inner feeling is made responsible for the good time with which a deaf and dumb girl was able to play the piano, " the whole of her person was actuated by measured movements of her inner feeling ".

It has been held that Lamarck's reputation has suffered from faulty translation of his works ; but to those who are competent to dispense with translation his works are not more acceptable, because his conclusions are contrary to the results of observation and experiment. When it is contended, as it has been, that the essence of Lamarckism is that when structures become necessary they appear, the matter ceases to belong to the realms of science. Animals strive for food, mates, and protection, and they scour for habitats and select them as Charles Elton[4] has stressed, which increases the possibilities of adaptation by multiplying the occasions for trial and error and exposing organisms of different genetic composition to different environments ; but this characteristic behaviour of mobile animals is not explained by ascribing an " inner feeling " to them ; nor is this an acceptable substitute for natural selection, mutation, and recombination of genes to account for evolution.

The similarity between Erasmus Darwin's " volition " and Lamarck's " inner feeling " as agents made responsible for evolution is remarkable, but there is no reason to suppose that the latter owed anything to the former ; still less to imagine that Darwin was not speaking the truth when he said of Lamarck's work that he " got not a fact or idea from it ".

Charles Lyell's work, without any doubt, exerted the most important influence on Darwin's thought. Curiously enough, this was not because of any facts which enabled Darwin to construct his theories of coral reefs or of evolution by natural selection ; on the contrary, in these subjects Darwin contradicted most of what Lyell had thought or written. It was the background of uniformitarianism in Lyell's *Principles of Geology* which provided Darwin with the general orientation of thought and method which enabled him to succeed where others, including Lyell himself,

[1] Lamarck. *Philosophie Zoologique*, vol. 2 p. 256 : le " *sentiment intérieur*, n'est point commun à tous les corps vivants, et ... ne l'est pas même à tous les animaux, ... est un sentiment ... dont sont doués les animaux qui ont un système nerveux assez développé pour leur donner la faculté de sentir."

[2] Lamarck. *op. cit.* vol 2, p. 259 : Les " émotions du sentiment intérieur, qui font agir les animaux et l'homme même, tantôt sans aucune participation de leur volonté, et tantôt par une volonté qui y donne lieu ... sentiment intérieur ... susceptible de s'émouvoir par des causes qui l'affectent ; or, ces causes sont toujours le besoin, soit d'assouvir la faim, soit de fuir les dangers, d'éviter la douleur, de rechercher le plaisir, ou ce qui est agréable à l'individu."

[3] Lamarck. *op. cit.* vol. 2, p. 262 : " toute sa personne etait mue par des mouvements mesurés de son sentiment intérieur."

[4] Charles Elton. *Animal Ecology and Evolution*, Oxford 1930, p. 51.

had failed to build and establish a coherent and scientifically satisfactory basis for biology.

As Professor Loren Eiseley[1] has so convincingly shown, it is an astonishing irony of history of science that Lyell did not discover Darwin's solution to the problem, for Lyell possessed all the ingredients which Darwin required to construct his theory. Already in 1832, the year in which the second volume of his *Principles of Geology* appeared, Lyell was familiar with the struggle for existence, ecological balance, the extinction of species, and even with the principle of natural selection by which extinction was brought about :[2] " A faint image of the certain doom of a species less fitted to struggle with some new condition in a region which it previously inhabited, and where it has to contend with a more vigorous species, is presented by the extirpation of savage tribes of man by the advancing colony of some civilized nation." But as Lyell in these early years refused to accept evolution, natural selection had no part to play in bringing it about in his scheme. Lyell recognized the succession of species and was well acquainted with the facts of geographical and geological distribution. The only thing which he rejected, as just stated, was evolution itself, and the curious reason for this has been admirably brought to light by Professor Eiseley.

Cuvier had broken the old notion of the scale of beings as a figurative single beanstalk, and had substituted for it a succession of stages of life, each terminated by a catastrophe. " Catastrophism " required that life started again after each revolution ; but as it was obvious that the forms of life showed progress in organization after each catastrophe, it was necessary to invoke a principle of " progressionism " on the part of the creative power. Imbued with the superior scientific value of uniformitarianism over catastrophism, Lyell repudiated the latter and, therefore, progressionism with it. The baby of evolution was thrown out with the bathwater of pseudo-geological magic, and Lyell missed one of the finest opportunities in the history of science. This was perhaps the greatest debt that Darwin owed to him.

The First Notebook contains a number of references to the names and works of other men, some of which may have been the start of ideas which subsequently played parts of great importance in the construction of Darwin's system. Among these is Cuvier whose views on the immutability of species Darwin of course challenged (pp. 53, 88, 89). But there is also a reference (p. 118) to some remarks by Cuvier's brother Frédéric on the production of domestic races of animals, in the course of which he wrote : " we could only produce domestic individuals and not races, without the concurrence of one of the most general laws of life, the transmission of the organic or intellectual modifications by generation. Here one of the most astonishing phenomena of nature manifests itself to us, the transmission of a *fortuitous* [our italics] modification into a durable form, of a fugitive want into a fundamental propensity, of an accidental habit into an instinct."

Professor Eiseley[3] has drawn attention to the extremely important question of what led Darwin to believe in the chance emergence of new characters. It is the

[1] Eiseley. *Darwin's century*, p. 102.
[2] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 175.
[3] Eiseley. *op. cit.* p. 202.

fundamental difference between the Darwinian view of fortuitous variation (which has been experimentally demonstrated by Sir Ronald Fisher as correct), and all other attempts to explain evolution as due to adaptively directed mutation. It is at the base of the argument about design. If variation were designed, as Darwin wrote[1] to Asa Gray, 26th November 1860, " you would have to believe that the tail of the Fantail was led to vary in the number and direction of its feathers in order to gratify the caprice of a few men "; and again[2] on 5th June 1861 : " It is not that designed variation makes, as it seems to me, my deity ' Natural Selection ' superfluous, but rather from studying, lately, domestic variation, and seeing what an enormous field of undesigned variability there is ready for natural selection to appropriate for any purpose useful to each creature." In the last pages of his book[3] *Variation of animals and plants under domestication*, Darwin drew up a fearsome list of consequences for those who believe in designed rather than in fortuitous variation, for they would be obliged to accept design as responsible for hosts of variations that are most injurious to the organisms concerned. Today, with modern knowledge of the properties of lethal genes, such arguments appear elementary, but in Darwin's day they were very topical, and it is at least probable that Frédéric Cuvier's remarks on " fortuitous modifications " started Darwin on this fundamentally important train of thought.

In the light of recent research on mutation of genes, the term " fortuitous " variation is preferable to the older term " random " variation, because although no correlation has ever been found between a mutagenic agent and the quality of adaptiveness in the character controlled by the resulting mutant gene, it is clear that chemical properties of mutagenic agents may induce some rather than other mutations. To this extent therefore mutations are fortuitous rather than random, since randomness implies equality of possibilities of mutation in any direction ; but equally there can be no question of biologically significant directedness in the mutations.

The geologist Leopold von Buch is not a source from which it is generally known that Darwin derived information or ideas for his special purposes, and yet in the Notebook of 1837 he is quoted twice for facts which were of supreme importance to Darwin. In the first (p. 156), von Buch related that on the island of Tristan d'Acunha, Du Petit Thouars found only 25 species of flowering plants of which some resembled the flora of the Cape and others that of South America. This played an important part in shaping Darwin's views on the colonization of islands and in framing the rhetorical question whether these species were created like this in order to deceive man (p. 218).

The second reference (p. 158) is even more important, for in it von Buch stated two fundamental propositions quite clearly :— that permanent varieties give rise to distinct species, and that geographical isolation of a region in which such a variety arises is the chief factor in its conversion into a new species by preventing intercrossing with the remainder of the parent population.

[1] *Life and Letters of Charles Darwin*, edited by Francis Darwin, vol. 2, 1887, p. 353.
[2] *Ibid.* vol. 2, p. 373.
[3] London 1868, vol. 2, p. 431.

That Darwin was indebted to Humboldt in a general way was known already from the *Autobiography*, but the Notebook shows (p. 142) that Humboldt's *Personal Narrative* contains a remark which reinforces that of von Buch : " The exclusion of all foreign mixture contributes to perpetuate varieties, or the aberrations from a common standard."

The part which isolation can play in the formation of species is mentioned in the *Origin of Species* (World's Classics p. 105), but in later life Darwin believed that it was not essential : a view contested by Moritz Wagner and Ernst Mayr.[1]

To Etienne Geoffroy-Saint-Hilaire it is possible that Darwin owed the germ of an idea of the relation between final and mediate causes. His name appears in the Notebook (p. 114) in connexion with the notion of the creator giving laws and leaving things to follow their consequences. This idea reappears in the *Sketch* of 1842 (p. 86), the *Essay* of 1844 (p. 254), and the *Origin of Species* (World Classics edition p. 559).

Mention must be made of the Hon. and Rev. William Herbert, the heterodox plant-breeder whose name figures in the Notebook (pp. 180, 191). He supplied Darwin with the information that in some genera the barrier of sterility between the species did not exist, and that there was no real difference between species and varieties.

Another man to whom Darwin was certainly indebted was William Paley, whose works on Natural Theology provided him with a catalogue of cases of adaptation and an argument which he used in reverse to show the efficacy of natural selection without design. His name does not appear in the extant portion of the Notebook, nor is there any reason why it should because neither adaptation nor the problem of design figure in it.

There was also John Stevens Henslow (mentioned on pp. 68 and 230), a devout believer in the fixity of species, to whom Darwin owed no particular information at all, but a great and loyal friendship, encouragement in his pursuits of natural history, the opportunity of embarking on the *Beagle*, and the suggestion that he should take with him (but not agree with) Lyell's *Principles of Geology*.

Edward Blyth was a man with whose works, as Professor Eiseley[2] has shown, Darwin who was his friend must have been familiar, but whose name and works do not appear in the extant portion of the First Notebook although they do in the Second. In a series of papers published between 1835 and 1837, Blyth touched on a number of subjects with which Darwin was concerned, including a remarkable description of the results of variation in species preyed upon by predators such as birds of prey. If the behaviour or colour of the variants departs from the typical specific character, either by failing in vigilance or in assuming a protective attitude or in matching its normal background, or in straying away from its normal background, such variants fall victim to the predator by the natural interplay of causes which remove " all that deviate from their normal or healthy condition, or which occur away from their proper and suitable locality ", and thereby " tend to limit the

[1] Ernst Mayr. " Isolation as an evolutionary factor ", *Proc. Amer. Phil. Soc.*, vol. 103, 1959, p. 221.
[2] Eiseley. " Charles Darwin, Edward Blyth and the Theory of Natural Selection ", *Proc. Amer. Phil. Soc.*, vol. 103, 1959, p. 94.

geographical range of species, and to maintain their pristine characters without blemish or decay to their remotest posterity." In other words, like Lyell before him (see above), Blyth who believed in special creation used the principle of natural selection to prove that species were immutable.

Bearing in mind that Darwin was after only one thing : how species became modified, it may be asked what Darwin's debt to Blyth was. So far as the construction of his theory is concerned, the answer is probably nothing at all. But Professor Eiseley also raises the question whether there were not items of information in Blyth's papers which Darwin built into his own body of knowledge, and bases it on the appearance in Darwin's notebooks and *Sketch* of expressions and statements which are also found in Blyth's papers. One such item is the word " osculant ";[1] others are mentions of Ancon sheep and of mutations such as polydactylous cats or rumpless fowls. Blyth's paper of 1835 and Darwin's First Notebook both contain mention of what Blyth called " the fact, equally well-known, of bullfinches . . . becoming wholly black when fed entirely on hempseed." Additional similar correspondences can probably be found, and although Darwin may have obtained some of them from other sources such as Lyell and Erasmus Darwin, and certainly found the expression " osculant " in the work of MacLeay, there is nothing improbable in his having copied some from Blyth. Indeed, Darwin's references to Blyth in the *Origin of Species, Variation in Animals and Plants under Domestication,* and the *Descent of Man,* are very numerous and generous on subjects other than how species become modified.

It forms no part of the intention of this study to defend Darwin from the imputation that he made unacknowledged use of Blyth's or any one else's work as regards the mechanism of natural selection. Darwin (and others) may have been wrong in thinking that he owed him or them nothing on this score.

Robert Edmund Grant surprised[2] Darwin as early as 1826 by speaking in high admiration of the work of Lamarck, and the anonymous paper[3] published in the *Edinburgh New Philosophical Journal* in that year when Darwin was in Edinburgh, was probably written by Grant. To this paper Darwin would not have felt himself any more indebted than to Lamarck's book, because it provided no facts that he

[1] Darwin used the word " inosculating " in his letter to Henslow dated 24 November 1832 (*Extracts from Letters addressed to Professor Henslow,* p.p. Cambridge 1835, p. 8). The source of the word is William Sharp MacLeay : *Horae entomologicae,* London 1819–21, p. 396 : " By an external order is meant one situated in the greater segment of a circle of affinity, when divided by a line joining its osculant points. There are ten such, viz. Orthoptera, Neuroptera, Homoptera, Hemiptera, Phalangidea, Scorpionidea? Amphipoda? Laemodipoda? Chilopoda and Thysanura. We may name the five orders, Vermes, Hymenoptera, Diptera, Acaridea, and Branchiopoda, internal, and the ten remaining inosculant, from their communicating with osculant groups." p. 37 " the nature of the genera that form the links of connexion. These genera I propose to call *osculantia,* from their occurring as it were at the point where the circles touch one another . . . " Murray *NED* : *Osculant* : — intermediate ; two groups united by some common characters and to an intermediate group which unites in itself the characters of two groups. MacLeay 1819, Kirby & Spence 1826 : *Entom.* 4, 382 : " They may form an osculant group, partly winged and partly apterous . . . "

Inosculate, to pass into ; to join ; to blend Kirby & Spence 1816 : Entom. 1, 332 : " hooks like those in the laminae of a feather inosculate into one another." Kirby. *Habits and Instincts of Animals,* II, 17, 168 : " The thigh inosculates with " the innominate.

[2] *Autobiography of Charles Darwin,* edited by Nora Barlow London 1958, p. 49.

[3] " Observations on the nature and importance of Geology ", *Edinburgh New Philosophical Journal,* vol. 1, 1826, p. 293.

could use, and the late Dr P. Helveg Jespersen has pointed out[1] that Grant shocked Darwin at the time by displaying scientific jealousy when he told Darwin that it was very unfair of him to work on the eggs of *Flustra*, material on which Grant was then engaged.

There are other cases in which Darwin simply forgot to mention his informants. The most striking case of this was his omission of the name of Wallace from the summary in the first edition of the *Origin of Species*.[2] In 1859 when writing[3] to Lyell about the succession of forms, Darwin forgot that he had himself published a paper on this subject in 1837. In 1860 when writing[4] to Baden Powell he excused himself for not having given a list of his predecessors who rejected special creation, saying that he had attempted no history of the subject ; yet later on the same day he remembered that he had a year or two previously drafted a Historical Sketch for his large work on evolution, in which Powell's name was mentioned with honour. All subsequent editions of the *Origin* contained the Historical Sketch. In 1880 when writing[5] to Samuel Butler about his introduction to Dr Krause' book on Erasmus Darwin, Darwin forgot that he had struck out a passage in proof which unintentionally altered the meaning of a footnote.

The only reason for mentioning these details is that they show, as Professor Eiseley has pointed out, that Darwin for all his eminence and genius was not different from other men ; and his Notebooks are like that of any other beginner casting around for facts with which to spin a hypothesis and by which to refute or establish it.

SUMMARY OF DARWIN'S CONCLUSIONS IN THE FIRST NOTEBOOK ON TRANSMUTATION

In order to provide a succinct account of the conclusions to which Darwin had arrived by February 1838, the following summary has been drawn up, leaving out all reference to subjects and questions on which he wanted further information or had not yet made up his mind. The page references are to the manuscript of the First Notebook.

" Definition of Species : one that remains at large with constant character . . . Species may be good ones and differ scarcely in any external character . . . Between species from moderately distant countries there is no test but generation whether good species " (pp. 212, 213).

Variation is observed between the progeny of parents reproducing by sexual methods. No variation is observed among the progeny of stocks reproducing by asexual methods such as budding, fission, or grafts. Therefore " generation ", which means sexual reproduction, is a mechanism whereby variation can be produced (p. 3).

Fully-developed organisms have difficulty in varying, but sexual reproduction

[1] P. H. Jespersen. " Charles Darwin and Dr. Grant ", *Lychnos* 1948–49, vol. 11, p. 159.
[2] *Life and Letters of Charles Darwin*, vol. 2, p. 264.
[3] *More Letters of Charles Darwin*, edited by Francis Darwin and A. C. Seward, London 1903, vol. 1, p. 133, to which attention was called by Eiseley : *Darwin's Century*, p. 163.
[4] " Some unpublished letters of Charles Darwin ", edited by Sir Gavin de Beer, *Notes and Records of the Royal Society of London*, vol. 14, 1959, p. 52.
[5] *Autobiography of Charles Darwin*, edited by Nora Barlow, London 1958, p. 182.

provides the means whereby new organisms can vary and become adapted to changed conditions, and conditions on earth have undoubtedly changed (p. 4).

With this tendency of organisms to produce varying offspring by sexual reproduction, why do species remain constant? Because interbreeding between variants in opposite directions quashes variation; and if a pair of breeding organisms be isolated it is very doubtful if their offspring will remain constant (pp. 5, 6). Therefore the offspring of animals on separate islands should become different if they are kept isolated long enough (pp. 5, 6, 7). "As we thus believe species vary, in changing climate we ought to find representative species". We do: e.g. Galapagos tortoises; Falkland Islands fox; English and Irish hare (p. 8). If new species result from isolation, their subsequent spread will be along rays from a centre (p. 155).

In islands near continents, recent arrivals would be similar to the organisms on the mainland; earlier arrivals might have varied provided that the original types had not continued to arrive. Examples: Galapagos Islands; Juan Fernandez (pp. 10, 11).

"Propagation" of species which means the origin of new species from other species, by descent, not by special creation, explains why on a continent there may be living species of the same type as extinct forms. Examples: Edentates in South America. "Parent of all armadilloes might be brother of Megatherium, uncle now dead". (pp. 14, 54).

Origination of species by descent from a common ancestor explains why in particular continents animals may have the same type of structure although the "necessity" for such structure may not be apparent; but it might have been "necessary" for their common ancestor, in which case "the result would be as it is". Examples: marsupials in Australia; antelopes in South Africa (pp. 12, 14).

In the course of time, all animals may change, and the longer the time since regions were separated, the greater the difference between their animals (pp. 15, 16).

The cause of variation is unknown, except that change is not the result of volition of animals but of adaptation (pp. 17, 21).

If the number of species in an isolated region remains "equable", and variation and multiplication have occurred, some species must have become extinct; and extinction of species is no more extraordinary than death of individuals (pp. 21, 22, 36).

If a variety (e.g. Petise ostrich) is not well adapted for its environment, it will probably perish. If a variety is well adapted (e.g. Orpheus) it will multiply. Extinction is therefore a consequence of non-adaptation (p. 38).

Organisms represent an irregularly branched tree. Some branches are more branched than others, and these are the genera; some twigs die and these are extinct species; new twigs are formed and these are newly originated species (p. 21).

Why do some genera contain aberrant species? "Is it an index of the point whence two favourable points of organization commenced branching?" (p. 28).

If a population remains constant in numbers, say 2000, then 400 years ago perhaps 150 people were the progenitors of the 2000 alive today. This means that there was a selection of ancestors with long progeniture.

Unless the population increases greatly, it is very unlikely that any one man of

a family of 12 will have offspring living 10,000 years hence. If this is true, the larger the group of organisms, the greater will be the gaps between them and the wider their divergence (pp. 40, 42, 146).

In Marsupials the splitting into orders analogous to carnivores, rodents, etc. can be seen just beginning (p. 141).

There is no justification for denying that mammals and fish may have a common ancestor when such strange intermediate forms as the platypus exist (p. 97).

" I cannot for a moment doubt but what Cetacea and Phocea now replace Saurians of Secondary epoch ". This is the principle of the occupation of ecological niches (p. 206).

" My theory will make me deny the creation of any new quadrupeds since days of Didelphys in Stonesfield." (p. 219).

If species are specially created, were South American and African species created on Tristan d'Acunha merely because it lies between Africa and South America, or to deceive man, like fossils in old formations? What was the creative power that was to create species on the Galapagos islands doing before those islands emerged above the sea? (pp. 98, 194, 218).

" Absolute knowledge that species die and others replace them. Two hypotheses : fresh creations is mere assumption ; points gained if any facts are connected." (p. 104).

" The Grand question which every naturalist ought to have before him when dissecting a whale, or classifying a mite, a grampus or an insect is What are the Laws of Life? " (p. 229).

SUBJECTS TREATED IN THE FIRST NOTEBOOK

The chief subjects included in the extant portion of the Notebook are :— reproduction, variation, constancy of variation, causes of variation, heredity, prepotency in crosses, hybridization, breeding-barriers, isolation, geographical distribution, centres of origin of species, conditions of life, radiation, ecological niches, means of transport, taxonomy, instincts, morphology, parasitology, palaeontology, geology, extinction, divergence.

Only the briefest references are made to the struggle for existence, selection, and adaptation.

The chief subjects missing are artificial selection, domestic breeds, conditions of domestication, inadequacy of climatic or other environmental conditions to account for resemblance and differences between floras and faunas, principle of gradations, sterility, imperfection of the geological record, affinities and classification, embryonic resemblance, vestigial organs, inheritance of effects of use and disuse.

How far these may have been included in the missing pages is hard to determine. The chief impression left after comparing the First Notebook with the *Sketch* of 1842 is that the latter is imbued with a dynamic background of necessitation which the extant portion of the former lacks. It is here that the effect of reading Malthus's work in October 1838 may most probably be discerned. The principle of selection of better adapted variants is present in the First Notebook (p. 38), but it is presented statically without indication of its universal compelling force.

Why this should be so, in spite of the fact that the struggle for existence was well known to Darwin from the works of Erasmus Darwin, Lamarck, and Lyell, was probably because Malthus was the first to state the problem quantitatively, stressing the discrepancy between the arithmetical rate of increase of food supplies and the geometrical rate of potential increase of organisms. It is in this light that the words should be read which Darwin wrote[1] in 1876: "In October 1838, that is, fifteen months after I had begun my systematic inquiry, I happened to read for amusement "Malthus on Population", and being well prepared to appreciate the struggle for existence which every where goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here then I had at last got a theory by which to work". The clock had been provided with a mainspring.

There is another point on which the First Notebook throws light, for it contains a splendid discussion of the principle of branching and sub-branching of the evolutionary tree (pp. 21, 22), and this shows that Darwin had already grasped fully the principle of divergence. This emerges also from his query whether Geoffroy-Saint-Hilaire visualized evolution as having taken place in straight or in branching lines (p. 113). The question naturally arises how this is to be reconciled with Darwin's statement[2] written in 1876 referring to the *Essay* of 1844: "But at that time I overlooked one problem of great importance. . . . This problem is the tendency in organic beings descended from the same stock to diverge in character as they become modified".

In trying to explain this discrepancy, Sir Francis Darwin[3] was mistaken in thinking that descent with modification necessarily implies divergence; evolution might take place along single lines without any divergence at all. The explanation emerges from a close attention to the *Origin of Species* [6th ed. World's Classics p. 112] where the problem is stated more forcibly: "How, then, does the lesser difference between varieties become augmented into the greater difference between species?" The problem is not only that of branching or splitting a species into two but of widening the split.[4]

What Darwin was referring to in 1876 was not the fact of divergence, for this was clearly stated in the First Notebook, but to a causal explanation of how it occurs and increases. This is also clear from the *Origin* [p. 113]:— "The more diversified the descendants from any one species become in structure, constitution and habits, by so much will they be better enabled to seize on many and widely diversified places in the polity of nature."

Darwin's other Notebooks on Transmutation of Species will be transcribed and printed in subsequent Numbers of this Bulletin.

[1] *Autobiography of Charles Darwin*, edited by Nora Barlow London 1958, p. 120.
[2] *Ibid.* p. 120.
[3] *Life and Letters of Charles Darwin*, vol. 2, p. 15.
[4] The date when Darwin hit on the solution of the problem of divergence ("I can remember the very spot on the road, whilst in my carriage, when to my joy the solution occurred to me," *Autob.* p. 120), may be placed in 1852 because of a letter from Darwin to George Bentham dated 19 June 1863 (*Life & Letters*, iii, p. 26): "I believe it was fifteen years after I began before I saw the meaning and cause of the divergence of the descendants of any one pair." If the "beginning" was in 1837, the solution came in 1852.

CHARLES DARWIN'S FIRST NOTEBOOK ON TRANSMUTATION OF SPECIES 1837–1838

Inside cover

C. DARWIN

All useful pages cut out.
Dec. 7 /1856/.
(and again looked through
April 21, 1873).[1]

This Book was commenced about July 1837; p. 235 was written in January
1 1838, | perhaps ended in beginning of February.

ZOONOMIA

Two kinds of generation: the coeval kind — all individuals absolutely similar; for instance, fruit trees, probably polypi, gemmiparous propagation, bisection of Planariae etc. etc.

The ordinary kind which is a longer process, the new individual passing through several stages (? typical or shortened repetition of what the original molecule has
2 done). — This appears | highest office in organisation (especially in lower animals, where mind and therefore relation to other life has not come into play) — see Zoonomia[2] arguments, fails in hybrids, where every thing else is perfect; mother apparently only born to breed, — annuals rendered perennial etc. etc. — Yet eunuch, nor cut stallions, nor nurses are longer lived.

Why is life short, why such high object — generation. —

We *know* world subject to cycle of change, temperature and all circumstances,
3 which | influence living beings.

We see the young of living beings become permanently changed or subject to variety, according to circumstance, — seeds of plants sown in rich soil, many kinds are produced, though new individuals produced by buds are constant; hence we see generation here seems a means to vary or adaptation. — Again we know, in course of
4 generation even mind and instinct becomes influenced. | Child of savage not civilized man. — Birds rendered wild generations acquire ideas ditto. V. Zoonomia. —

There may be unknown difficulty with *full grown* individual with fixed organisation thus being modified, — therefore generation to adapt and alter the race to *changing* world. —

On other hand, generation destroys the effect of accidental injuries, which if
5 animals lived for ever would be endless | (that is with our present system of body and universe. — Therefore final cause of life).

With this tendency to vary by generation, why are species all constant over whole country. Beautiful law of inter-marriages partaking of characters of both parents and then infinite in number.

[1] On this first page Darwin wrote a series of figures in running vertical order, and subsequently scored them out; they were: 26, 30, 41, 46, 50, 54, 66, 67, 69, 76, 79, 91, 93, 107 Ireland, 113, 117.

[2] Erasmus Darwin. *Zoonomia; or, the laws of organic life*, London 1794, vol. 1, p. 487: "This paternal offspring of vegetables, I mean their buds and bulbs, is attended with a very curious circumstance: and that is, that they exactly resemble their parents, as is observable in grafting fruit-trees, and the propagating flower-roots; whereas the seminal offspring of plants, being supplied with nutriment by the mother, is liable to perpetual variation."

6 In man it has been | said, there is instinct for opposites to like each other.

Aegyptian cats and dogs, ibis — same as formerly, but separate a pair and place them on fresh island, it is very doubtful whether they would remain constant; is it not said that marrying-in *deteriorates* a race, that is alters it from some end which is good for man. — |

7 Let a pair be introduced and increase slowly, from many enemies, so as often to intermarry — who will dare say what result.

According to this view animals on separate islands, ought to become different if kept long enough apart, with slightly differ[ent] circumstances. — Now Galapagos tortoises, mocking birds, Falkland fox, Chiloe fox. — English and Irish Hare. — |

8 As we thus believe species vary, in changing climate we ought to find representative species; this we do in South America closely approaching. — But as they inosculate, we must suppose the change is effected at once, — something like a variety produced 9 — every grade in that case [it] seems is not | produced? —

Species according to Lamarck[1] disappear as collection made perfect. — Truer even than in Lamarck's time. Gray's[2] remark, best known species (as some common land shells) most difficult to separate. [Difference in] Every character continues to vanish, — bones, instinct etc. etc. etc. |

10 Non-fertility of hybridity etc. etc.

If species (1) may be derived from form (2) etc., — then (remembering Lyell's[3] arguments of transportal) island near continents might have some species same 11 as nearest land, which were late arrivals, | others old ones (of which none of same kind had in interval arrived) might have grown altered. Hence the type would be of the continent, though species all different. —

2 cases as Galapagos and Juan Fernandez.

When continent of Pacific existed, might have been monsoons. When they ceased, 12 importation ceased and | changes commenced; — or intermediate land existed; — or they may represent some large country long separated. —

On this idea of propagation of species we can see why a form peculiar to continents, 13 — all bred in from one parent. Why Megathera several | species in S. America? why 2 [species] of ostriches in S. America. — This is answer to Decandolle[4] (his argument applies only to hybridity): genera being usually peculiar to same country, different genera — different countries. |

14 Propagation explains why modern animals — same type as extinct, which is law almost proved. — We can see why structure is common in certain countries when

[1] Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, vol. 1, p. 75: "à mesure que nos collections s'enrichissent, nous voyons presque tous les vides se remplir et nos lignes de séparation s'effacer . . . plus nous rencontrons de preuves que tout est nuancé, que les différences remarquables s'évanouissent."

[2] John Edward Gray. Probably personal communication.

[3] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, pp. 96–104.

[4] Augustin-Pyramus de Candolle. *Essai élémentaire de géographie botanique*, Strasbourg 1820, p. 60: "Les différences constantes des végétaux nés dans diverses régions ne semblent se rapporter ni à l'une ni à l'autre de ces classes [= produites par les élémens extérieurs + formées par l'hybridité] on ne peut les attribuer aux circonstances externes, . . . on ne peut les attribuer à l'hybridité. . . . [Les] espèces sont distribuées sur le globe en partie d'aprés des lois qu'on peut immédiatement déduire de la combinaison des lois connues de la physiologie et de la physique, en partie d'après les lois qui paroissent tenir à l'origine des choses et qui nous sont inconnues." [This question was discussed by Lyell, *Principles of Geology*, vol. 2, London 1832, p. 56.]

we can hardly believe necessary, but if it was necessary to one forefather, the result
15 would be as it is. — Hence antelopes at C. of Good Hope and | Marsupials at Australia. —

Will this apply to whole organic Kingdom when our planet first cooled. —

Countries longest separated — greatest differences, — if separated from immersage, possibly two distinct type[s], but each having its representatives — as in Australia

This presupposes time when no mammalia existed; Australia; Mamm[alia] were produced from propagation from different set as the rest of the world. — |
16 This view supposes that in course of ages, and therefore changes, every animal has tendency to change. —

This difficult to prove cats etc. from Egypt no answer, because time short and no great change has happened. —
17 I look at two Ostriches as strong argument of possibility of such | change; as we see them in space, so might they in time. —

As I have before said, *isolate* species, especially with some change, probably vary quicker. —
18 Unknown causes of change. Volcanic island. — Electricity. | Each species changes. Does it progress.

Man gains ideas.

The simplest cannot help becoming more complicated; and if we look to first origin, there must be progress.

If we suppose monads are constantly formed, would they not be pretty similar
19 over whole world under | similar climates and as far as world has been uniform at former epoch. How on this Ehrenberg?[1]

Every successive animal is branching upwards different types of organisation improving as Owen[2] says simplest coming in and most perfect and others occasionally
20 dying out; for instance, secondary terebratula may | have propagated recent terebratula, but Megatherium nothing.

We may look at Megatherium, Armadillos and Sloths as all offsprings of some still older type. Some of the branches dying out. —

With this tendency to change (and to multiplication when isolated) requires
21 deaths of species to keep numbers | of forms equable. But is there any reason for supposing number of forms equable: This being due to subdivisions and amount of differences, so forms would be about equally numerous. —

Changes not result of will of animals, but law of adaptation as much as acid and alkali.

Organized beings represent a tree, *irregularly branched*; some branches far more branched, — hence genera. — As many terminal buds dying, as new ones generated. |
22 There is nothing stranger in death of species, than individuals.

If we suppose monad definite existence, as we may suppose in this case, their creation being dependent on definite laws; then those, which have changed most,
23 owing to the accident of positions must in each state of existence have shortest | life. Hence shortness of life of Mammalia. —

[1] Christian Gottfried Ehrenberg. *Die fossilen Infusorien und die lebendige Dammerde*, Berlin 1837.
[2] Richard Owen. Probably personal communication.

Would there not be a triple branching in the tree of life owing to three elements — air, land and water, and the endeavour of each typical class to extend his domain
24 into the other domains and subdivision[s] three more double arrangement. — | If each main stem of the tree is adapted for these three elements, there will be certainly points of affinity in each branch.

A species as soon as once formed by separation or change in part of country, repugnance to intermarriage — settles it. |

25 ? We need think that fish and penguins really pass into each other.—

The tree of life should perhaps be called the coral of life, base of branches dead, so that passages cannot be seen. — [fig. 1]

26 This again offers | no [(] only makes it excessively complicated [)] Contradiction to constant succession of genera in progress.

Fig. 1

Fig. 2

Is it thus fish can be traced right down to simple organization. — Birds — not. [fig. 2]
27 | We may fancy according to shortness of life of species that in perfection the bottom of branches deaden, — so that in mammalian tree it would only appear like circles, and insects amongst articulate, — but in lower classes perhaps a more linear arrangement. — |

28 ? How is it that there come aberrant species in each genus (with well characterised parts belonging to each) approaching another.

Petrels have divided themselves into many species, so have the awks [auks], there is particular circumstance, to which.

Is it an index of the point, whence two favourable points of organization commenced branching. — |

29 As all the species of some genera have died, have they all one determinate life dependent on genus, the genus upon another, whole class would die out therefore.
30 [*remainder of page excised*] | [*beginning of page exised*] In island neighbouring continent where some species have passed over, and where other species have " air " of
31 that place, will it be said those have been then created there : — | Are not all our

British shrews diff[erent] species from the continent. Look over Bell[1] and L. Jenyns.[2] Falkland rabbit may perhaps be instance of domesticated animals having effected, a change which the Fr[ench] naturalists thought was species. Study Lesson[3] — Voyage of Coquille. — |

32 Dr Smith[4] says he is certain that when white man and Hottentots or Negroes cross at C[ape] of Good Hope, the children cannot be made intermediate. The first children partake more of the mother, the later ones of the father ; is not this owing to each copulation producing its effect ; as when bitches ' puppies are less purely bred owing to having once born mongrels. He has thus seen the black blood come out from the grandfather (when the mother was nearly quite white) in the two first children. How is this in West Indies — Humboldt,[5] New Spain. — |

33 Dr Smith[6] always urges the distinct locality or metropolis of every species ; believes in repugnance in crossing of species in wild state. —

No doubt C.D.[7] wild men do not cross readily, distinctness of tribes in T.del Fuego. The existence of whiter tribes in centre of S. America shows this. — Is there a tendency in plants hybrids to go back? — If so man and plants together would establish law as above stated : no one can doubt that less trifling differences are blended |

34 by intermarriages, then the black and white is so far gone, that the species (for species they certainly are according to all common language) will keep to their type : in animals so far removed with instinct in lieu of reason there would probably be repugnance and art required to make marriage. — As Dr Smith[8] remarked man and wild animals in this respect are differently circumstanced. — |

35 ? Is the shortness of life of *species* in certain orders connected with gaps in the *series of connection*? if starting from same epoch certainly. The absolute end of certain forms from considering S. America (*independent of external causes*) does appear very probable : — Mem.: Horse, Llama, etc. etc.

If we grant similarity of animals in one country owing to springing from one branch, and the monucle has definite life, then all die at one period, which is not

∴ MONUCULE NOT DEFINITE LIFE. |

36 I think Case must be that one generation then should have as many living as now.

[1] Thomas Bell. *A History of British Quadrupeds*, London 1837. On p. xviii there is a notice pointing out that the *Sorex araneus* of British authors is not the *S. araneus* of the continent. Ellerman & Morrison-Scott (*Checklist of Palaearctic & Indian Mammals*, London 1951, p. 51) accord the status of a geographical race to the British *Sorex araneus castaneus* Jenyns 1838.

[2] Leonard Jenyns, afterwards Blomefield. *A Manual of British Vertebrate Animals*, London 1835, p. 17 : " incisors deep feruginous brown* * This circumstance together with one or two others, induces me to suspect that the *S. araneus* of the continental authors may be distinct from ours." This suspicion was verified by Jenyns in his paper " Further remarks on the British shrews ", *Ann. Nat. Hist.*, vol. 1, p. 417 ; especially p. 424.

[3] René-Primevère Lesson & Prosper Garnot. *Voyage autour du monde . . . sur . . . la Coquille, pendant . . .* 1822–1825. *Zoologie*, Paris 1826–30.

[4] Dr, later Sir Andrew Smith. Personal friend of Darwin who met him in South Africa in June 1836.

[5] Friedrich Heinrich Alexander von Humboldt. *Political essay on the Kingdom of New Spain*, transl. from the original French by John Black, New York 1811.

[6] Andrew Smith. *Report of the expedition for exploring Central Africa from the Cape of Good Hope, June 23 1834, under the superintendence of Dr. A. Smith*, Cape Town, 1836. Appendix, p. 39 : " most of the species we met with, appeared to have each a natural or chosen domicile, where an evident congregation of its members existed."

[7] Charles Darwin. *Journal of Researches*, (London 1839), p. 236 : " each [tribe] is surrounded by other hostile ones, speaking different dialects."

[8] Andrew Smith. Probably personal communication.

To do this and to have many species in same genus (as is), *requires* extinction. [fig. 3]

Thus between A and B immens[e] gap of relation, [between] C and B the finest gradation, [between] B and D rather greater distinction. Thus genera would be
37 formed, — bearing relation | to ancient types, — with several extinct forms, for if each species as ancient (1) is capable of making 13 recent forms. Twelve of the contemporaries must have left no offspring at all, so as to keep number of species constant. —

With respect to extinction we can easily see that variety of ostrich Petise may not be well adapted, and thus perish out, or on other hand like Orpheus being favour-
38 able, | many might be produced. This requires principle that the permanent varieties, produced by confined breeding and changing circumstances are continued and produce according to the adaptation of such circumstances, and therefore that

Fig. 3

death of species is a consequence (contrary to what would appear from America) |
39 of non-adaptation of circumstances. — Vide two pages back Diagram.

The largeness of present genera renders it probable that many contemporary [genera] would have left scarcely any type of their existence in the present world. — Or we may suppose only each species in each generation only breeds, *like* individuals in a country not rapidly increasing. — |

40 If we thus go very far back to look to the source of the Mammalian type of organization, it is extremely inprobable that any of the successors of his relations shall now exist. —

In same manner, if we take a man from any large family of 12 brothers and sisters
41 in a state which does not increase, | it will be chances against any one of them having progeny living ten thousand years hence ; because at present day many are relatives, so that by tracing back the fathers would be reduced to small percentage : — therefore the chances are excessively great against any two of the 12 having progeny after that distant period. — |

42 Hence if this is true that the *greater the groups* the *greater the gaps* (or *solutions* of *continuous structure*) between them. — for instance, there would be great gap
43 between birds and mammalia, still greater between | vertebrate and articulate, still greater between animals and plants. —

But yet besides affinities from three elements, from the infinite variations, and all coming from one stock and obeying one law, they may approach—some birds may approach animals and some of the vertebrate invertebrate. — Such or few on
44 each side will yet present some anomaly and bearing | stamp of some great main type, and the gradation will be sudden. —

Heaven know whether this agrees with Nature : *Cuidado!*

The above speculations are applicable to non-progressive development, which certainly is the case at least during subsequent ages. — |

45 The Creator has made tribes of animals, adapted preeminently for each element, but it seems law that such tribes, as far as compatible with such structure, are in minor degree adapted for other elements. Every part would probably be not complete, if birds were fitted solely for air and fishes for water. —

46 If my idea of origin of | Quinarian system[1] is true, it will not occur in plants which are in far larger proportion terrestrial, — if in any in the Cryptogamic flora. — but not atmospheric type hence probably only four, is not this Fries[2] rule, what subject has Mr Newman the (7) man[3] studied.

The condition of every animal is partly due to direct adaptation and partly to
47 hereditary taint ; hence the | resemblances and differences, for instance, of finches of Europe and America, etc. etc. etc.

The new system of Natural History will be to describe limits of form (and where possible the number of steps known).

48 Examine good collection of insects with this in view. — | Geogr. Journal. Vol. VI, P. 11, p. 89. — Lieut. Wellsted[4] obtained many sheep from Arabian count[ries]. " These were of two kinds : one white with a black face, and similar to those brought from Abyssinia, and others dark brown, with long clotted hair resembling that of goats ". |

49 Progressive development gives final cause for enormous periods anterior to man. Difficult for man to be unprejudiced about self, but considering power, extending range, reason and futurity, it does as yet appear cli. [cut off] |

50 In Mr Gould['s] Australian work[5] some most curious cases of close but certainly

[1] William Sharp MacLeay. Quinarian theory, see Introduction.

[2] Elias Magnus Fries. Fries's rule is given in John Lindley : " Some account of the Spherical and Numerical System of M. Elias Fries," *Phil. Mag. & Journ.*, vol. 68, Aug. 1826, p. 81 : " the founder of the system of quaternary arrangement ... opinions are contained in the Introduction to a work published by M. Fries in 1825, under the title of *Systema Orbis Vegetabilis.*"

p. 86 : " When the members of a bipartite section are again dichotomously divided upon analogous principles, four sections are created, of which the first and second, and the third and fourth, are in affinity ; but the first and third, and the second and fourth, are in analogy. But when this method of division becomes circuitous, a more direct path is undoubtedly to be discovered : hence other numbers are admitted, especially the quaternary (or double dichotomy), and also others in which dichotomy is understood." (Reference kindly supplied by W. T. Stearn).

[3] Edward Newman. *See* Introduction.

[4] Lieutenant R. Wellsted. " Observations on the Coast of Arabia between Rás Mohammed and Jiddah," *Journ. Roy. Geogr. Soc.*, vol. 6, 1836, p. 51, especially p. 89.

[5] John Gould. *The Birds of Australia and the adjacent Islands*, London 1837.

distinct species between Australia and Van Diemen's land, and Australia and New Zealand. Mr Gould says in subgenera they undoubtedly come from same countries. — In mundine genera |

51–52 *excised.*

53 | ... and whether extinction of great S. American quadrupeds part of some great system acting over whole world, the period of great quadrupeds declining as great reptiles must have once declined. —

Cuvier[1] (Read his theory of the Earth attentively) objects to propagation of species, by saying, why not have some intermediate forms been discovered between palaeo-

54 therium, megalonyx, mastodon and the species now living. — Now, according | to my view, in S. America parent of all armadilloes might be brother to Megatherium — uncle now dead. —

Bulletin Geologique, april 1837, p. 216. Deshayes[2] on change in shells from Salt and F[resh] Water on what is species. *Very good.* Has not Macculloch[3] written on same changes in Fish.

Mem. Rabbit of Falklands described by Q[uoy] and G[aimard][4] as new species. Cuvier examined it. |

55–56 *excised.*

57 ... something occurs with regards to other tribes in that same family. —

(NB. I see Waterhouse[5] thinks Quinary only three elements.) How far does Waterhouse's representatives agree with breeding in irregular trees and extinction of forms?? It is in simplest case saying every species in genus resembles each other (at least in one point, in truth in all excepting specific character) ; and in passing from species

58 to genera, each retains | some one character of all its family ; but why so? I can see no reason for these analogies ; from the principle of atavism, where real structure obliged to be altered, I can conceive colouring retained ; therefore probably in some Heteromera colouring of C[h]rysomela may be going back to common ancestor of C[h]rysom[ela] and Heterom[era], but I cannot understand the universality of such law. — |

[1] Georges Cuvier. *Essay on the theory of the earth*, with geological illustrations by Professor Jameson, Edinburgh & London 1817, p. 102 : " Why may not the presently existing races of land quadrupeds, ... be modifications of those ancient races which we find in a fossil state ; ... If the species have changed by degrees, we ought to find traces of these gradual modifications. Thus, between the palaeotheria and our present species, we should be able to discover some intermediate forms ; and yet no such discovery has ever been made."

[2] Gérard-Paul Deshayes. *Bull. Soc. Geol. France*, vol. 8, 1836 à 1837, Paris 1836 [1837], p. 216 : " Dans les espèces tertiaires de la Crimée, les modifications dans les caractères des dents de la charnière sont encore beaucoup plus nombreuses. On y observe une multitude de combinaisons dans la forme, la position, la présence ou l'absence, comme dans le plus ou moins de développement des dents cardinales et latérales, variations que M. Deshayes attribue à un changement de milieu ; il pense que d'abord marines, ces coquilles auront continué de vivre dans les eaux douces qui ont remplacé les eaux salées."

[3] John MacCulloch. " On the possibility of changing the residence of certain fishes from salt water to fresh ", *Quart. Journ. Sci.*, vol. 17, 1824, p. 209.

[4] Jean-René-Constantin Quoy & Joseph-Paul Gaimard. *Voyage Autour du Monde ... Zoologie*, Paris 1824, contains no description of the Falkland Islands rabbit. But Prosper Garnot : " Remarques sur la Zoologie des îles Malouines, faites pendant le Voyage autour du monde de la Corvette la Coquille," *Ann. Sci. Nat.*, vol. 7, p. 39, contains on p. 42 a description of a rabbit " que nous croyons pouvoir considérer comme une espèce nouvelle bien distincte, et que nous proposons de nommer lapin magellanique, (*Lepus magellanicus* Garnot)."

[5] George Robert Waterhouse. " Description of some new species of exotic insects," *Trans. Entom Soc. Lond.*, vol. 2, 1837, p. 188. On p. 190 [His views] " may go a great way to prove or disprove an exceedingly ingenious and favourite theory—I mean the circular and quinary system ; for it may happen that in the formation of this theory analogies may in some instances have been mistaken for affinities."

59 It would be curious to know in plants (or animals) whether *races* have tendency to keep to either parent (this is what French call *atavism*). Probably this is first step in dislike to union, offspring not well intermediate.

Lyell,[1] vol. III, p. 379. Mammalian type of organization same from one period to another, preeminently Pachidermata, less so in Miocene and so on. — |

60 As I have traced the great quadrupe[d]s to Siberia, we must look to type of organization : extinct species of that country — parents of American. — Now genera of these two countries ought to be similar. — |

61 ? Law : existence definite without change, superinduced, or new species. Therefore animals would perish if there was nothing in country to superinduce a change? |

62 Seeing animals[s] die out in S. America with no change, agrees with belief that Siberian animals lived in cold countries and therefore not killed by cold countries.

Seeing how horse and elephant reached S. America, — explain how zebras reached South Africa. —

63 It is a wonderful fact — Horse, Elephant and Mastodon dying out | about same time in such different quarters. — Will Mr Lyell[2] say that some circumstance killed it [them] over a tract from Spain to S. America? — (*Never*). They die, without they change, like golden Pippins ; it is a *generation* of *species* like generation of *individuals*. — |

64 Why does individual die? To perpetuate certain peculiarities (therefore adaptation), and to obliterate accidental varieties, and to accomodate itself to change (for, of course change even in varieties is accomodation). Now this argument applies to species. — If individual cannot propagate, he has no issue ; so with species. — |

65 I should expect that Bears and Foxes are same in N. America and Asia ; but many species closely allied, but different, because country separated since time of extinct quadrupeds ; — same argument applies to England. — Mem. Sh[r]ew mice |

66 Animals common to South and North America. — ? *Are there any*? |

67 Rhinoceros peculiar to Java and another to Sumatra. — Mem. Parrots peculiar, according to Swainson,[3] to certain islets in East India archipelago. —

Dr Smith[4] considers probable that northern species *replace* southern kinds.

Gnu reaches Orange river and says : so far will I go and no further. — |

68 Prof. Henslow[5] says that when race once established, so difficult to root out. — For instance ever so many seeds of white flower all would come up white, though planted in same soil with blue. Now this is same bearing with Dr Smith's fact of races of man ... |

69–70 *excised.*

71 Strong odour of negroes — a point of real repugnance. —

Waterhouse[6] says there is no TRUE *connection* between great groups. — |

[1] Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 379.

[2] Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 142 : " Successive extinction of species consistent with their limited geographical distribution " (cross-heading) ... " They must die out ", to borrow an emphatical expression from Buffon ; " because Time fights against them."

[3] William Swainson. *A treatise on the geography and classification of animals*, Lardner's Cabinet Cyclopaedia, London 1835, p. 52 : " The suctorial cockatoos of Malacca, the elegant ring-necked parrakeets of the continent, and the crimson-coloured lories of the islands, are appropriated solely to these regions."

[4] Andrew Smith. Probably personal communication.

[5] John Stevens Henslow. Probably personal communication.

[6] George Robert Waterhouse. Probably personal communication.

72 Speculate on land being grouped towards centre near Equator at former periods and then splitting off. —

If *species* generate other *species*, their race is not utterly cut off : — like golden pippins, if produced by seed, go on, — otherwise all die. — The fossil horse generated
73 in S. Africa zebra — and continued, — perished in America. | All animals of same species are bound together just like buds of plants, which die at one time, though produced either sooner or later. — Prove animal[s] like plants : — trace gradation between associated and non-associated animals — and the story will be complete. — |
74 It is absurd to talk of one animal being higher than another — *We* consider those, where the { cerebral structure / intellectual faculties } most developed, as highest. — A bee doubtless would where the instincts were [most developed] |

75–76 *excised.*

77 There appears in Australia great abundance of species if few genera or families. — (long separated.) — Proteaceae and other forms (?) being common to Southern hemisphere. Does not look, as if S. Africa peopled from N. Africa. |

78 An originality is given (and power of adaptation is given by *true* generation), through means of every step of progressive increase of organization being imitated in the womb which has been passed through to form that species. — |

79 Mr Don[1] remarked to me, that he thought species became obscurer as knowledge increased, but genera stronger. Mr Waterhouse[2] says no real passage between good genera. — How remarkable spines, like on a porcupine or Echidna. —

Good to study Regne animal[3] for *Geography*. — |

80 The motion of the earth must be excessive up and down. — Elephants in Ceylon. — East India archipelago. — West Indies. — Opossum and Agouti same as on continent — 3 Paradoxusi[4] in common to Van Diemen's Land and Australia. England and Europe, Ireland — common animals. Ireland longer separate. Hare[s] of two countries different. — Ireland and Isle of Man possessed elk, not England. Did Ireland possess mastodons?? Negative facts tell for little. — From the consideration of these archipelagos ups and downs in full conformity with European formations, — for instance, tertiary deposits between East India islets. — |

81 Geographic distribution of Mammalia more valuable than any other, because less easily transported — then plants on coral islets. — Next to animals land birds. — And life shorter or change greater. — In the East Indian Archipelago it would be interesting to trace limits of large animals. — |

82 Owls : transport mice alive?

Species formed by subsidence. Java and Sumatra. Rhinoceros. Elevate and join keep distinct, two species made ; elevation and subsidence continually forming species. —

The male animal, affecting *all* the progeny of female, insures often mixing of individuals. |

[1] George Don. Probably personal communication.
[2] George Robert Waterhouse. Probably personal communication.
[3] Georges Cuvier. *Le Règne animal*, Paris 1829.
[4] i.e., platypus (*Ornithorhynchus paradoxus*).

83 South Africa — proof of subsidence and recent elevation : pray ask Dr Smith[1] to state that most clearly. —

Fox[2] tells me, that beyond all doubt seeds of Ribstone Pippins produce Ribstone Pippins, and Golden Pippins — goldens ; hence *sub-varieties* and hence possibility of reproducing any variety, although many of the seeds will go back. Get instances of a *variety* of fruit tree or plant run wild in foreign country. Here we have avitism the ordinary event and succession the extraordinary. |

84 When one sees nipple on man's breast, one does not say some use, but sex not having been determined ; — so with useless wings under elytra of beetles, born from beetles with wings and modified, — if simple creation, surely would have [been] born without them. — |

85 In some of the lower orders a perfect gradation can be found from forms marking good genera by steps so insensible that each is not more change than we know *varieties* can produce.—Therefore all genera MAY have had intermediate steps. Quote *in detail* some good instance.

86 But it is other question whether there | have existed *all* those intermediate steps, especially in those classes, where species not numerous. (NB. In those classes with few species greatest jumps — strongest marked genera ? Reptiles?). For instance,

87 there never may have been grade between pig and tapir, yet from some | common progenitor. — Now if the intermediate links had produced infinite species, probably the series would have been more perfect, because in each there is possibility of such organization. (Spines in Echidna and Hedgehog.) —

88 As we have one Marsupial animal in Stonesfield slate, the father of all | mammalia in ages long gone past and still more so known with fishes and reptiles. —

In mere eocene rocks we can only expect some steps. — I may ask whether the

89 series is not more perfect by the discovery of fossil Mammalia than before, | and that is all that can be expected. This answers Cuvier.[3] —

Perhaps the father of Mammalia as heterodox as Ornithorhynchus. If this last animal bred — might not new classes be brought into play. — |

90 The father being climatized — climatizes the child? — Whether every animal produces in course of ages ten thousand varieties (influenced itself perhaps by circumstances) and those alone preserved which are well adapted? This would account for each tribe acting as in vacuum to each other. |

91 p. 306. — Chamisso[4] on Kamtchatka quadrupeds. Kotzebues[5] first Voyage. Entomological Magazine, paper[6] on Geographical range. Copied with list. Richardson's[7] Fauna Borealis.

[1] Andrew Smith. " 1836 June 1–15 . . . with Dr A. Smith who has lately returned from his most interesting expedition to beyond the Tropic, I took some long geological rumbles." *Charles Darwin's Diary of the Voyage of the Beagle*, edited by Nora Barlow, Cambridge 1934, p. 409.

[2] William Darwin Fox. Probably personal communication.

[3] Georges Cuvier. *Essay on the Theory of the Earth*, Edinburgh and London 1817, p. 102.

[4] Adelbert von Chamisso. In *A Voyage of Discovery into the South Sea and Beering's Straits, etc.* by Otto von Kotzebue, (Remarks and Opinions of the Naturalist of the Expedition Chamisso) vol. 3, London 1821, p. 306.

[5] Otto von Kotzebue. *A Voyage of Discovery into the South Sea and Beering's Straits etc.*, London 1821.

[6] " Delta ". "Thoughts on the Geographical Distribution of Insects ", *Entomol. Mag.*, London 1835, vol. 2, pp. 44, 280.

[7] Sir John Richardson. *Fauna Boreali-Americana* ; or *the zoology of the northern parts of British America*, London, 1829–1837.

It is important the possibility of some islands not having large quadrupeds. — |

92 Humboldt[1] has written on the geography of plants : Essai sur la Geographie des Plantes. I vol. in 4°.

I have abstracted Mr Swainson's[2] tract at beginning of Volume on geographical distribution of animals. |

93 Geograph. Journal,[3] vol. I, p. 17–21, says from Swan river long south coast, all the remarkable Australian genera collected together. —

Man has no *hereditary prejudices* or wishes to conquer or breed together. — Man has no limits to desire, in proportion instinct more, reason less, so will aversion be. |

94 L'Institut,[4] 1837, No. 246, a section of fossil " singe ", it cannot be made to approach the Colobus, which in South Africa appear to represent the semnopitheque of India. — Tooth of Sapajou, — NB. Sapajou is S. American form : therefore it is

95 like case of great edentate (has been doubted?) | and opossum, found in Europe, now confined to southern hemisphere. — If these facts were established it would go to show a *centrum* for Mammalia. — I really think a very strong case might be made out of world before Zoological divisions.

Man : species doubtful when known only by bones.

Mem. Silurian fossils :? how are South American shells? |

96 Do not plants, which have male and female organs together, yet receive influence from other plants — Does not Lyell[5] give some argument about varieties being difficult to keep on account of pollen from other plants because this may be applied to show all plants do receive intermixture. — But how with hermaphrodite shells!!!? |

97 We have not the slightest right to say, there never was common progenitor to mammalia and fish, when there now exist such strange forms as ornithorhync[h]us. —

The type of organization constant in the shells. — |

98 The question if creative power acted at Galapagos, it so acted that birds with plumage and tone of idea purely American, North and South, — so permanent a breath cannot reside in space before island existed. — Such an influence must exist in such spots. We know birds do arrive and seeds. (And geographical division are arbitrary and not permanent. This might be made very strong if we believe

[1] Friedrich Heinrich Alexander von Humboldt. *Essai sur la géographie des plantes*, Paris 1805. [= Vol. 2 Part V of Humboldt, F. H. A. von, & Bonpland, A. J. A.:— *Voyage aux régions équinoxiales du Nouveau Continent, fait en* 1799–1804, Paris 1805–1837].

[2] William Swainson. *A Treatise on the Geography and Classification of Animals. Lardner's Cabinet Cyclopaedia*, London 1835, chapter I.

[3] Robert Brown. " General view of the botany of the vicinity of Swan River," *Journ. Roy. Geogr. Soc.*, vol. 1, p. 18 ; " this portion of the shores of New Holland, extending from Swan River on the West coast to Middle Island . . . on the south coast, may be said to contain the greatest proportion of those genera which form the chief peculiarities of New Holland Vegetation."

[4] William Martin. *L'Institut*, Paris vol. 6, 1838, No. 246, p. 300. [This paper was not published until 13th September 1838. It refers to a paper read before the Zoological Society of London on 11th July 1837 : " Mr. Martin then laid before the meeting the following observations on the Proboscis Monkey, or ' Guenon à long nez ' " *Proc. Zool. Soc. Lond.*, Part V, 1837, p. 70. There is no number 246 of the *Institut* in 1837. Darwin's reference therefore must be incorrect. The paper referred to here contains no reference to fossil monkeys. There are several references to fossil monkeys in *L'Institut* in 1837, but none on page 246, and none refers to *Colobus*.]

[5] Charles Lyell. *Principles of Geology*, London 1832, vol. 2, p. 33 : varieties of cultivated plants cannot originate nor be maintained without the intervention of man, because " it is only by strong manures that these varieties have been obtained, and in poorer soils they instantly degenerate." But even if the manure supply were kept up by herds of wild animals the varieties could not be maintained because of cross-pollination.

the Creator creates by any laws, which I think is shown by the very facts of the geological character of these islands.) |

99 The same remarks applicable to fossil animals same type, — armadillos like every created [edentate]. — Passage for vertebrae in neck — same cause ; such beautiful adaptation, yet other animals live so well. — This kind of propagation gives hiding-place for many unintelligible structures — it might have been of use in progenitor, or it may be of use, — like mammae on men's breast. — |

100 How does it come wandering birds such [as] sandpipers not new at Galapagos. — Did the creative force know these species could arrive — did it only create those kinds not so likely to wander — did it create two species closely allied to Mus[cicapa] coronata, but not coronata. — We know that domestic animals vary in countries without any assignable reason. |

101 Astronomers might formerly have said that God ordered each planet to move in its particular destiny. In same manner God orders each animal created with certain form in certain country, but how much more simple and sublime power let attraction act according to certain law, such are inevitable consequences — let animal be created,
102 then by the fixed laws of generation, such will be their successors. | Let the powers of transportal be such, and so will be the forms of one country to another. — Let geological changes go at such a rate, so will be the number and distribution of the species!! |

103 It may be argued representative species chiefly found where barriers or what are barriers by interruption of communication, or when country changes. Will it [be] said that volcanic soil at Galapagos under equator, that external conditions would produce species so close as Patagonian and Galapagos Orpheus. — Put this strong so many thousand miles distant. — |

104 Absolute knowledge that species die and others replace them. — Two hypotheses : fresh creations is mere assumption, it explains nothing further ; points gained if any facts are connected.[1] —

No doubt in birds ; mundine genera are birds, (bats, foxes, Mus) that are apt to
105 wander and of easy transportal. — Waders and | waterfowl — scrutinize genera and draw up tables. — Instincts may confine certain birds which have wide power of flight ; but are there any genera, mundine, which cannot transport easily. It would have been wonderful if the two Rhea had existed in different continents. — In plants I believe not. — |

106 It is a very great puzzle why Marsupials and Edentata should only have left offsprings in or near South Hemisphere. Were they produced in several places and died off in some? Why did not fossil horse breed in S. America. It will not do to say period unfavourable to *large* quadrupeds, horse not large. — |

107–108 *excised.*

109 . . . but not vice versa. (Could plants live without carbonic acid gas. Yet unquestionably animals most dependent on vegetables of the two great kingdoms. |

110 Principes de Zool. Philosoph.[2] : — I deduce from extreme difficulty of hypothesis

[1] This is an early appearance of the argument frequently used by Darwin to the effect that the value of a hypothesis increases with the number of facts which it explains.

[2] Etienne Geoffroy-Saint-Hilaire. *Principes de Philosophie Zoologique*, Paris 1830, pp. 54 ff. (hypothesis that Cephalopod molluscs provided a link between invertebrates and vertebrates).

of connecting mollusca and vertebrata, that there must be very great gaps. — Yet some analogy. The existence of plants and their passage to animals appears greatest argument against theory of analogies. |

111 [Saint-Hilaire] states there is but one animal,[1] one set of organ[s] ; the others [he] assumes CREATED with endless differences : — does not say propagated, but must have concluded so — Evidently or hints considers generation as a short process by which one animal passes from worm to man highest or typical of changes which can be traced in *same* organ in *different* animals in scale. — In monsters also organs |

112 of lower animals appear. — Yet nothing about propagation — I see nothing like grandfather of Mammalia and birds — &c.

p. 32, reference to M[ilne] Edwards'[2] law of crustacea with respect to mouth, those beautiful passages from one to other organ. — Cuvier[3] on opposite side ; 1st vol of Fish.

p. 59. Cuvier[4] has said each animal made for itself does not agree with old and modern types being constant. Cuvier's[5] theory of *Conditions* of existence is thought to account [for] resemblances and .·. quinary system, on three elements. p. 66. |

113 With unknown limits, every tribe appears fitted for as many situations as possible ; conditions will not explain states, for instance, take birds, animals, reptiles, fish. — (Perhaps consideration of range of capabilities past and present might tell something.)

p. 111. G. St. Hilaire Insects and Molluscs allowed to be wide hiatus : states in one the sanguineous system, in other nervous developed.[6] (Owen's idea). States these class[es] approach on the confines? Balanida? I cannot understand whether S.H. thinks development in quite straight line or branching. — |

114 S.H. What does the expression mean used by Cuvier,[7] that all animals (though

[1] Etienne Geoffroy-Saint-Hilaire. *Principes de Philosophie Zoologique*, Paris 1830, p. 22 : " il n'est plus d'animaux divers. Un seul fait les domine, c'est comme un seul être qui apparaît." *Ibid.* p. 214 : " Il n'y a donc pas plusieurs animaux, à proprement parler, mais un seul animal, dont les organes varient dans la forme, l'usage et le volume, mais dont les materiaux restent toujours les mêmes, au milieu de ces surprenantes métamorphoses."

[2] Henri Milne-Edwards. " Sur l'organisation de la bouche chez les crustacés suceurs (1830) *Ann. Sci. Nat.*, vol. 28, 1833, p. 78 : transformation of normal mouth with mandibles and maxillae into sucking tube, elongated, but " la composition organique décrite est toujours restée analogique. Les mêmes élémens constituans sont retrouvés dans l'un et l'autre cas ; c'est une tendance remarquable à l'uniformité de composition."

[3] Georges Cuvier. Darwin made this note from E. Geoffroy-Saint-Hilaire's *Principes de Philosophie Zoologique*, Paris 1830, p. 57, where Cuvier is quoted as saying " Tout nouvellement encore, dans le premier volume de mon *Histoire des Poissons*, j'ai exprimé mon sentiment à ce sujet, sans doute avec le ton modéré que les sciences réclament, et avec la politesse qui appartient à tout homme bien élevé."

[4] Georges Cuvier. Darwin made this note from Geoffroy-Saint-Hilaire ; *Principes de Philosophie Zoologique*, Paris 1830, p. 59 where Cuvier's earlier article on " Nature ", in Levraut's *Dictionnaire des sciences naturelles* is quoted :— " Ces vues d'*unité* sont renouvelées d'une vieille erreur née au sein du panthéisme, étant principalement enfantée par une idée de causalité, par la supposition inadmissible que *tous les êtres sont crées en vue les uns des autres* ; cependant chaque être est fait pour soi."

[5] This reference appears to be to Etienne Geoffroy-Saint-Hilaire, *Principes de Philosophie Zoologique* p. 66 on which there is a footnote by St Hilaire (referring to Conditions) on Cuvier's argument about resemblance.

[6] Etienne Geoffroy-Saint-Hilaire. *Principes de Philosophie Zoologique*, Paris 1830, p. 111 : " Le système sanguin est en excès et au contraire le système nerveux est frappé d'atrophie chez les mollusques ; c'est l'inverse chez les insectes." Loi de compensation.

[7] Georges Cuvier. Darwin appears to be quoting from E. Geoffroy-Saint-Hilaire *Principes de Philosophie Zoologique*, Paris 1830, p. 56 where Cuvier is quoted as saying : " j'ai toujours soutenu que le plan, qui jusqu'à un certain point est commun aux vertébrés, ne se continue pas chez les mollusques." Cf. also *Le règne animal*, Paris 1829, vol. 1 p. 48 : " on trouvera qu'il existe quatre formes principales, quatre plans généraux, si l'on peut s'exprimer ainsi, d'après lesquels tous les animaux, semblent avoir été modelés."

some may be) have not been created on the same plan. ("Second resumé" well worth studying). H.[1] says grand idea God giving laws and on them leaving all to follow consequences. —

I cannot make out his ideas about propagation. His work Philosophie anatomique (2d vol. about monsters[2] worth reading.) |

115 NB. Well to insist upon large mammalia not being found on all islands (if act of fresh creation, why not produced on New Zealand ; if generated, an answer can be given). —

It is a point of great interest to prove animals not adapted to each country. —

116 Provision for transportal otherwise not so numerous : quoted from Lyell[3]; | assuming truth of quadrupeds being created on small spots of land of the same type with the great continents, we get a means of Knowing of movements. —

How can we understand, excepting by propagation, that out of the thousand of

117 new insects all belong to same | types already established. Why out of the thousands of forms should they all be classified. Propagation explains this. —

Ancient Flora thought to [be] more uniform than existing.[4] — Ed. n. Philos. J., p. 191, No. 5, [vol. 3] Apr. 1827. |

118 F. Cuvier[5] says : "But we could only produce domestic individuals and not races, without the occurrence of one of the most general laws of life — the transmission of a fortuitous modification into a durable form, of a fugitive want into a fundamental propensity, of an accidental habit into an instinct". Ed. n. Phi. J., p. 297, No. 8, Jan.–Apr. 1828. — I take higher grounds and say life is short for this object and others, viz. not too much change. |

119 In number 6 ? of Ed. n. Phil. Journ. Paper by Crawford[6] on Mission to Ava, account of HAIRY (because ancestors hairy) man with one hairy child, and of *albino* DISEASE being banished, and given to Portuguese priest. — In first settling a country, people very apt to be split up into many isolated races! Are there any instances of peculiar people banished by rest? — ∴ Most monstrous form has tendency to propagate as well as diseases. |

[1] Etienne Geoffroy-Saint-Hilaire, *Principes de Philosophie Zoologique*, Paris 1830, p. 219: "La puissance créatrice, par des combinaisons aussi simples a produit l'ordre actuel de l'univers, quand elle eut attribué à chaque chose sa qualité propre et son degré d'action, et qu'elle eut réglé que tant d'élémens, ainsi sortis de ses mains, seraient éternellement abandonnés au jeu, ou mieux, à toutes les conséquences de leurs attractions réciproques." This concept appears in the *Sketch* of 1842, (p. 86), *Essay* of 1844 (p. 253), and the *Origin* (World's Classics Edition p. 559).

[2] Etienne Geoffroy-Saint-Hilaire. *Philosophie anatomique. Des Monstruosités humaines*, Paris 1822. In referring to "2nd vol.", Darwin was regarding the work *Philosophie anatomique*, Paris 1818 as vol. 1.

[3] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, chapters VI and IX, 5th edition, London 1837, chapters VIII and IX.

[4] Anonymous. "Scientific intelligence. 9. On the distribution of living and fossil plants." *Edin. New. Phil. Journ.* vol. 3, April–June 1827, p. 190. On p. 191 : "the same genera and species [of fossil plants] are found in the most remote regions where the plants now in existence are entirely different."

[5] Frédéric Cuvier (1773–1838, brother of Baron Georges Cuvier). "Essay on the domestication of mammiferous animals . . ." *Edin. new. Phil. Journ.*, vol. 4, April 1828, p. 297.

[6] John Crawfurd. "Account of Mr. Crawfurd's Mission to Ava." *Edin. new. Phil. Journ.*, vol. 3, July–September 1827, p. 359. On p. 368 : "a man covered from head to foot with hair . . . The hair on the face of this singular being, the ears included, is shaggy, and about eight inches long . . . has two daughters . . . the youngest is covered with hair like her father . . . Albinos occur, now and then . . . We saw two examples : one of these, a young man of twenty . . . They were ashamed of him, and considered him little better than a European, they made him over to the Portuguese clergy man."

120 In intermarriages: smallest differences blended, rather stronger tendency to imitate one of the parents; repugnance generally to marriage before domestication, afterwards none or little with fertile offspring; marriage never probably excepting from strict domestication, offspring not fertile or at least most rarely and perhaps never female. — No offspring: physical impossibility to marriage. — |

121 ? Whether those genera which unite very different structure as *petrel* and *alk* do not show the possibility of common branching off?

Accra,[1] Coast of Africa. Clay slate, strike SSW and NNE, and 30°–80° C°. — Ed. Phil. n. J., p. 410, 1828 |

122 It is daily happening, that naturalist[s] describe animals as species, for instance — Australian dog or Falkland rabbit. — There is only two ways of proving to them it is not; one when they can proved descendant, which of course most rare, or when placed together they will breed. — But what a character is this? — |

123–128 *excised.*

129 The relation of analogy of MacLeay[2] etc. appears to me the same as the irregularities in the degradation of structure of Lamarck,[3] which he says depends on external influences. — For instance he says wings of bat are from external influence. — |

130 Hence name of analogy, the structures in the two animals bearing relation to a third body, or common end of structure.

A Race of domestic animals made from influences in one country is permanent in another. — Good argument for species not being so closely adapted. |

131 Near the Caspian province of Ghilan wooded district, cattle with humps[4] as in India. Geograph. J. — Vol. III, P. 1, p. 17, (Lat. about 37°). Vol. IV, P. 1, Geograph. Journal. Voyage up the Massaroony by W. Hillhouse.[5] — Demerara. In note Demerara 10–12 feet beneath surface forest trees fallen, kind well known, carbonized; clay, fifty feet, then forest 120 ft., micaceous rocks; subsidence appears indicated. — p. 36. — |

132 Geograph. Journ., Vol. IV, P. II, p. 160. Melville Island: " the buffaloes, introduced from Timor, herded separate from the English cattle, nor could we get them to associate together ".[6] |

[1] Thomas Park. In " Scientific intelligence: Mr. Thomas Park's journey into the interior of Africa," *Edin. new Phil. Journ.*, vol. 4, March–April 1828, p. 410.

[2] William Sharp MacLeay. *Horae Entomologicae*, London 1819–1821. The " relations of analogy " are conceived as " existing between corresponding points of the two contiguous circles which pass through a perfect change of form " (p. 391) e.g. the Decapoda in the Crustacean circle have " relations of analogy " with the Araneidea of the Arachnid circle, while the latter's Acaridea have " relations of analogy " with the Diptera of the Haustellata circle.

[3] Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, vol. 1, p. 153: degradation is the result of less progress in the perfection and composition of the organization, and must be distinguished from the effects of environment and contracted habits. E.g., seals owe their imperfect limbs to the water in which they live, as do whales; but seals are less degraded than whales because their organization is less degraded in its essential parts.

[4] Colonel William Monteith. " Journal of a tour through Azerdbijan and the shores of the Caspian," *Journ. Roy. Geogr. Soc.*, vol. 3, 1834, p. 1. On p. 17: " Their features more resemble Indians, and the cattle are small, having also the hump peculiar to that country."

[5] William Hillhouse. " Journal of a voyage up the Massaroony in 1831." *Journ. Roy. Geogr. Soc.*, vol. 4, 1834, p. 25.

[6] Major Campbell. " Geographical memoir of Melville Island, and Port Essington on the Coburg Peninsula Northern Australia . . . " *Journ. Roy. Geogr. Soc.*, vol. 4, 1834, p. 129 (160).

133 There is long rigmarole articles by S. Hilaire[1] on wonder of finding monkey in France — of genus peculiar to East Indian isles. — Compares it to fossil Didelphis (S. American genus) in plaster of Paris. — Now this is exception to *law of type*, like horse in S. America or like living Edentata in Africa etc. etc. — Now if suppose
134 world more perfectly continental, we might have | wanderers (as Peccari in N. America) ; then if it is doomed that only one species of family has offspring the *chance* is that these wanderers would not, but where original forms most numerous,
135 there would be wanderers. — Some however might have offspring, and then | (v. L'Institut,[2] p. 245 [recte 243], 1837) we should have anomalies, as Cape anteater. — This supposes world divided into Zoological provinces, united — and now divided again. — Weakest part of theory death of species without apparent physical cause. — Mem.: Mastodon all over S. America. Hilaire[3] does not seem (?) to consider the monkey as a wanderer, but as produced by climate? — |

136 M. Baer[4] (thinks) the Auroch was found in Germany and thinks even now in central and eastern Asia beyond the Ganges and perhaps even in India — p. 261, L'Institut, 1837.

Mem.: F[ox] Darwin[5] cross breed boars were wilder than parents, which is same as Indian Cattle. ∴ Tameness not hereditary? Having been gained in short time. |

137 Milvulus forficatus is a great flycatcher doing the service of a swallow.

I think we may conclude from Australia and S. America, that only some mundine cause has destroyed animals over the whole world. — For instance, gradual reduction of temperature from geographical or central heat. — But the shells. |

138 Mr Yarrell[6] says that old *races* when mingled with newer, hybrid variety partakes chiefly of the former. Eyton's[7] paper on Hybrids, Loudon's Magazine. Gould[8] on Motacilla Loudon's Mag., September or October 1837 species peculiar to Continent and England. |

[1] Etienne Geoffroy-Saint-Hilaire. " Singe fossile de Sansan ", *L'Institut*, 5, 1837, p. 242 : " Ce n'est point un singe généralement parlant que M. Lartet a découvert dans notre Europe, mais précisément l'analogue de l'une de ces formes qu'on ne rencontre que dans cette région décidément à part, où la spécialité d'essences animales propres aux Indes Orientales et soumises à l'influence d'un milieu ambiant d'une sorte déterminée."

[2] Darlu. *L'Institut*, Paris 5, 1837, 218, p. 245. This paper deals with fossil mammals in deposits of gypsum near Meaux and contains no reference to the wanderings of mammals, nor to their anomalous distribution. Darwin's reference must therefore be incorrect, and should read p. 243 : cf. next footnote.

[3] Etienne Geoffroy-Saint-Hilaire. *L'Institut*, vol. 5, 1837, p. 243 : " n'allez pas conclure qu'en recourant à l'accumulation hypothétique des siècles, vous finiriez par construire une route géographique bien servie par la nature des diverses températures, immédiatement à ce propices, afin que les espèces, Sarigue et Gibbon, aujourd'hui vivantes en leur contrée respective, aient fourni des voyageurs vers un point voisin de leur antipode et soient venus ainsi déposer en France les débris, juste sujet de notre admiration, que nous avons cités dans cet écrit ; non, il n'en est point ainsi. Je m'en tiens pour dénégation, quant à ce sujet, aux principes et aux données philosophiques de mes mémoires sur les milieux ambians . . . "

[4] N. Baer. " Aurochs du Caucase " *L'Institut*, Paris, 5, 1837, 218, p. 260.

[5] William Darwin Fox. Probably personal communication.

[6] William Yarrell. Probably personal communication.

[7] Thomas Campbell Eyton. " Some remarks upon the theory of hybridity ", *Mag. Nat. Hist.* N.S., vol. 1, 1837, p. 357.

[8] John Gould. " Observations on some species of the genus Motacilla of Linnaeus." *Mag. Nat. Hist.*, vol. 1, September 1837, p. 459. Distinction between *Motacilla flava* Ray of Britain and *M. neglecta* of France and Holland. The pied wagtail of Britain, Norway and Sweden, has its place taken in France by *M. alba* L. *M. lugubris* Pallas is restricted to eastern Europe.

139 Westwood[1] has written paper on affinity and analogy in Linnaean Transactions.

Mr Wynne[2] distinctly says that the mixture between Chinese and English Breed decidedly exceedingly prolific, and hybrid about half way. Eyton[3] says Hybrid about half aways [way], and results the same. Indian cattle and common produced
140 very fine | hybrid offspring, much larger, than the dom[estic] from those imported by L[ord] Powis. Hybrid dogs offspring seldom intermediate between parents. — How easily does Wolf and Dog cross? Mr Yarrel[4] thinks oldest variety impresses the offspring most forcibly. Esquimaux dog and pointer.

Game-fowls have courage independently of individual force. |

141 Mr Wynne[5] has crossed Duck and Widgeon, and offspring either amongst themselves or with parent birds.

W. [Darwin] Fox[6] knew of case of male widgeon winged and turned on pool; first season bred readily with common ducks.

Kirby[7] all through Bridgewater errs greatly in thinking every animal born to consume this or that thing. — There is some much higher generalization in view.

In Marsupial division do we not see — splitting in orders carnivora, rodents etc. JUST COMMENCING. |

142 Kirby[8] says (not definite information) west of Rocky Mountains asiatic types discernible. — Bridgewater Treatise, p. 85. Parasites of negroes different from European.[9] — Horse and ox have different parasites in different climates. —

Humb[oldt],[10] Vol. V, P. II, p. 565. Consult. Says types most subject to vary where intermixture precluded. — |

143 Kirby[11] Bridgewater Treatise. There are some good accounts of passages of legs

[1] John Obadiah Westwood. "On Diopsis, a Genus of Dipterous insects", *Trans. Linn. Soc. Lond.* vol. 17, 1837, p. 283. On p. 285: "as these instances* involve in some degree the doctrine that every affinity is connected with, and must be tested by, a corresponding analogy . . ." (* footnote: lateral prolongation of the head into ocular peduncles).

[2] Wynne. Untraced.

[3] Thomas Campbell Eyton. "Some Remarks upon the Theory of Hybridity", *Mag. Nat. Hist.*, N.S., London 1837, vol. 1, p. 357.

[4] William Yarrell. Probably personal communication.

[5] Wynne. Untraced.

[6] William Darwin Fox. Probably personal communication.

[7] William Kirby. *On the power, wisdom, and goodness of God, as manifested in the creation of animals and in their history, habits, and instincts*, (The Bridgwater Treatises) London 1835, vol. 1, p. 141: "There is another function which is devolved upon animals with respect to the vegetable kingdom: to keep the members of it within due limits" vol. 2, p. 496: "the vegetable tenants of the ocean require to be kept within due limits, . . . amongst other creatures to whom this province is assigned, are some Crustacea.' vol. 2, p. 514: "The general functions of this Order [Carnivora] are to check the tendency to increase not only in their own Class, the Mammalians, but in most of the other Classes of Animals."

[8] William Kirby, *op. cit.* vol. 1, p. 52: "On the Rocky Mountains, and in the country westward of that range, Asiatic types are discoverable, both in the vegetable and animal kingdoms."

[9] William Kirby. *op. cit.* vol. 1, p. 85: "Little stress will be laid on the parasite of the negroes (*Pediculus Nigritarum*), being specifically distinct from that which infests the whites, when we reflect that the horse and the ox have different parasites and assailants in different climates."

[10] Friedrich Heinrich Alexander von Humboldt. *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, during the years* 1799–1804, translated by Helen Maria Williams, London 1821, vol. V, p. 565: "The exclusion of all foreign mixture contributes to perpetuate varieties, or the aberrations from a common standard."

[11] William Kirby. *op. cit.* vol. 2, p. 75: "in this Order of the Myriapods we see the first tendency towards employing what in Hexapods wear the form and perform the functions of legs as auxiliaries of the *mouth*."

into mouthpieces of Crustacea. Vol. II, p. 75. A Fish which emigrates over land,[1] a silurus, p. 123. A climbing fish,[2] p. 122. A terrestrial annelidous animal,[3] p. 347, Vol. I. — compare with my planariae.[4] Leaches out of water. |

144 Does the odd Petrel of T. del F. take form of awk because there is no awk in Southern Hemisphere? Does this rule apply? |

145 A Treatise on Form of Animals by Mr Cline :[5] " The character of both parents are observed in their offspring, but that of the male more frequently predominates ". p. 20 ditto : " If hornless ram be put to horned ewe almost all the lambs will be hornless ". Does this apply to when same animal breeds often with same male.

p. 23 " It is wrong to enlarge a native breed of animals, for in proportion to their increase of size they become worse in form, less handy, and more liable to disease ". |

146 If population of place be constant, say 2000, and at present day every ten living souls on average are related to the (200dth year) degree, then 200 years ago there were 200 people living who now have successors. Then the chance of 200 people, being related within 200 years backward, might be calculated and this number eliminated ; say 150 people four hundred years since were progenitors of present people, and so on backwards to one progenitor, who might have continued breeding from eternity backwards. — |

147 If population was increasing between each lustrum, the number related at the first start must be greater, and this number would vary at each lustrum and the calculation of chance of the relationship of the progenitors would have different formula for each lustrum. We may conclude that there will be a period, though long distant, when of the present men (of all races) not more than a few will have 148 successors. At present day in looking at two fine families one will | [have] successors for centuries, the other will become extinct. —

Who can analyse causes, dislike to marriage ; hereditary disease, effects of contagions and accidents ; yet some causes are evident as, for instance, one man killing another. — So is it with *varying* races of man : then races may be overlooked mere variations consequent on climate etc. — the whole races act towards each other and are acted on, just like the two families no doubt a different set of causes must act in the two cases. —

[1] William Kirby. *op. cit.* vol. 1, p. 122 : " Another migrating fish was found by thousands in the ponds and all the fresh waters of Carolina, by Bosc ; and as these pools are subject to be dry in summer, the Creator has furnished this fish, as well as one of the flying ones (*Exocoetus*), by means of a membrane which closes its mouth, with the faculty of living out of water, and of travelling by leaps, to discover other pools."

[2] William Kirby. *op. cit.* vol. 1, p. 123 : " Another fish (*Perca scandens*), found by Daldorff, in Tranquebar, not only creeps upon the shore, but even climbs the Fan palm in pursuit of certain Crustaceans which form its food."

[3] William Kirby. *op. cit.* vol. 1, p. 347 : " My late indefatigable and talented friend, the Rev. L. Guilding once found a *land* species, in an ancient wood in the Island of St. Vincent's, which from its soft body he regarded as a Molluscan, but from its figure, and annulose structure, its jointed antennae, and seemingly jointed legs crowned with bristles, it (*Peripatus juliformis*) certainly belongs, as Mr. Gray has remarked, to the present class [Annelida]."

[4] Charles Darwin. *Journal of Researches*, London 1839, p. 30 : " The terrestrial Planariae, of which I have found no less than eight species, occur from within the tropic to lat. 47° south, and are common to South America, New Zealand, Van Diemen's Land, and Mauritius."

[5] Henry Cline. *On the form of animals*, London 1805. *Observations on the Breeding and Form of Domestic animals*, London 1829.

May this not be extended to all animals, first consider species of cats etc. etc. Exclude mothers and then try this as simile. |

149 In a decreasing population at any one moment fewer closely related, ∴ (few species of genera) ultimately few genera (for otherwise the relationship would converge sooner), and lastly perhaps some one single one.— Will not this account for the odd genera with few species which stand between great groups, which we are bound to consider the increasing ones. —

NB. As illustration are there many anomalous lizards living, or of the tribes fish extinct, or of Pachydermata, or of coniferous trees, or in certain shell cephalopoda. — Read Buckland.[1] |

150 L'Institut, 1837, p. 319. Brongniart[2] — no dicotyledonous plants and few monocot [yledonous] in coal formation? p. 320. States cryptogam[ic] Flora formerly common to New Holland?! p. 320. Says Coniferous structure intermediate between vascular or Cryptogam (original Flora) and Dicotyledones, which nearly first appear (p. 321) at Tertiary epochs. p. 330. Fossil Infusoria found of unknown forms, a circumstance undiscovered by Ehrenbergh.[3] — |

151–154 *excised.*

155 . . . Indian cow with hump and common ; — between Esquimaux and European dog? Yet man has had no interest in perpetuating these particular varieties.

If species made by isolation, then their distribution (after physical changes) would be on rays — from certain spots. — Agrees with old Linnaean[4] doctrine and Lyell's[5] to certain extent. |

156 Von Buch[6] — Canary Islands : French Edit. — Flora of Islands very poor (p. 145) : 25 plants [Tristan da Cunha]. 36 St. Helena without ferns. — Analogous to nearest continent ; poorness in exact proportion to distance (?) and similarity of type (?) (Mem.: Juan Fernandez[7]). From study of Flora of islands : " ou bien encore on pourrait au plus en conclure quels sont les genres qui, sous ce climat, se divisent le plus aisément en espèces distinctes et permanentes ", p. 145. In Humboldt[8] great

[1] William Buckland. *Geology and Mineralogy considered with reference to Natural Theology*, London 1836.

[2] A. Brongniart. " Végétaux fossiles ", *L'Institut*, Paris 5, 1837, 220, p. 318.

[3] Christian Gottfried Ehrenberg. *L'Institut*, Paris 5, 1837, p. 330 : " Paléontologie : infusoires fossiles du tripoli d'Oran. M. Ehrenberg communique l'extrait d'une lettre de M. Agassiz de Neuchâtel sur le tripoli d'Oran qu'il a reconnu être formé de corps organisés microscopiques et silicifiés."

[4] Carolus Linnaeus. " Oratio de telluris habitabilis incremento ", reprinted in *Amoenitates Academicae*, vol. 2, contains a hypothesis of diffusion of plants and animals from the Island of Paradise. It is probable that Darwin's source was the English translation by F. J. Brand : *Select dissertations from the Amoenitates Academicae*, London 1781. (Information kindly supplied by W. T. Stearn ; cf. his " Botanical Exploration to the time of Linnaeus ", *Proc. Linn. Soc. Lond.*, 169 Session 1956–7, London 1958, especially pages 193 and 194).

[5] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 126.

[6] Leopold von Buch. *Description physique des Iles Canaries*, par Léopold de Buch traduite de l'Allemand par C. Boulanger, Paris 1836, p. 144 : " Le célèbre naturaliste français Du Petit-Thouars ne trouve, sur l'Ile de Tristan d'Acunha . . . pas plus de 25 différentes espèces de plantes phanérogames, dont les unes rappellent la végétation du Cap, les autres celle de l'Amérique, à peu prés également distante, et leur nombre à Sainte- Hélène, d'après le Catalogue de Risburgh, ne monte pas à plus de 36 espèces."

[7] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 154 has a reference to the introduction of goats into Juan Fernandez.

[8] Friedrich Heinrich Alexander von Humboldt. *De Distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena*, Lutetiae Parisiorum, 1817, p. 39 : " si, in singula zona, *specierum* numerum cum numero *generum* confers, cui illae adscribuntur, tum versus polum, tum versus cacumina montium, longe plura genera invenies, quam locis planis et calidioribus. Sic alit Gallia inter 3645 species phanerogamas 683 genera, cum in Laponia 487 Phanerogamae ad 212 genera referuntur ; unde rationes fiunt 5, 7 : 1 et 2, 3 : 1."

157 work | De distribut. plantarum relation of genera to species in France is 1 : 5·7, in Laponia 1 : 2·3. Mem.: Lyell[1] on shells. —

	genera
In North Africa	1 : 4·2
Iles Canaries	1 : 1·46
St. Helena	1 : 1·15

Calculate my Keeling case ; Juan Fernandez ; Galapagos. — Radack Islands. —
158 ∴ Islands and Arctic are in same relation. We find | species few in proportion to difficulty of transport. For instance, the temperate parts of Teneriffe : the proportion of genera 1 : 1. I can understand in one small island species would not be manufactured. Does it not present analogy to what takes place from time? Von Buch[2] distinctly states that permanent varieties become species, p. 147–150, — not being crossed with others. — Compare it to languages. But how do plants cross? ——— Admirable discussion. |

159–160 *excised.*

161 Mr Owen[3] suggested to me, that the production of monsters (which Hunter[4] says owe their origin to very early stage) and which follow certain laws according to species, present an analogy to production of species. —

Animals have no notion of beauty, — therefore instinctive feelings against other species for sexual ends, whereas man has such instincts very little. |

162 In Zoǫlog. Proceedings, June 1837, by Eyton[5] account of three kinds of pigs. Difference in skeletons : VERY GOOD.

Apteryx, a good instance probably of rudimentary bones. — As Waterhouse[6] remarked mere length of bill does not indicate affinity because similar habits produce similar structure. — Mem.: Ornithorhync[h]us.

Would not *relationship* express a real affinity and affinity whales and fish? — |

163 Progeny of Manks-cats without tails : some long and some short, therefore like dogs.

[1] Charles Lyell. *Principles of Geology*, vol. 3, London 1833. Appendix I. M. Deshayes's Table of Shells, gives the number of species in each genus of selected living and Tertiary shells, in various localities.

[2] Leopold von Buch. *op. cit.* p. 148 : " Un lieu se trouve-t-il isolé par des obstacles naturels, par des chaînes de montagnes qui établissent une séparation plus effective que des espaces considérables de mer interposés, on peut toujours s'attendre à y trouver des espèces de plantes entièrement nouvelles, et ne croissant pas dans les autres parties de l'île. Un hasard favorable a peut-être porté, par un enchainement particulier de circonstances, des semences pardessus les montagnes. Abandonnée à elle-même, la variété qui résulte des nouvelles conditions auxquelles elle est soumise, y formera, avec le cours du temps, une espèce distincte, qui s'èloigne d'autant plus de sa forme primitive, qu'elle reste plus longtems dans cette région isolée, exempte d'autres influences."

[3] Richard Owen. Probably personal communication.

[4] John Hunter. *Observations on certain parts of the Animal Oeconomy*, London 1837, with notes by Richard Owen. P. 26 [":] I should imagine," he writes, " that monsters were formed monsters from their very first formation, for this reason, that all supernumerary parts are joined to their similar parts, as a head to a head &c. &c."

[5] Thomas Campbell Eyton. " Notice of some Osteological Peculiarities in different skeletons of the Genus *Sus* ", *Proc. Zool. Soc. Lond.*, 1837, pt. V, p. 23.

[6] George Robert Waterhouse. Probably personal communication.

Ogleby[1] says : Wolves at Hudson bay breed with dogs, — the bitches never being killed by them, whilst they eat up the dogs. —

L'Institut. Curious paper by M. Serres[2] on Molluscous animals representing foetuses of Vertebrata etc. 1837, p. 370. Owen[3] says nonsense. |

164 The distribut[ion] of big animals in East Indian Archipelago, very good in connection with Von Buch Volcanic chart and my idea of double line of intersection. —

At India House collection of Birds from Java. — At Leyden series from several islands. — Bear peculiar to Sumatra and not found on Java. — Monkey peculiar to latter, not to former. — Dr Horsfield.[4] |

165–166 *excised.*

167 ? Consult Dr. Smith[5] History of S. African cattle.

Phillips Geology,[6] p. 81, in Lardners Encyclop. Proportion between fossils and recent shells, between herbivorous and zoophagous mollusca according to periods. —

NB. Was Europe desert (like S. Africa) after Coal Period? |

168 ? In those divisions of mollusca, where species now least in number (as cephalopods), in last tertiary epoch most genera dead? — Examine into this in Phillips.[7] — According to this formerly there would have been many genera of monotrematous animals. — p. 82. There are many tables in Phillips of numerous genera in fossil and recent state well worth consideration. — |

169 Tabulate Mammalia on this principle.

Man in *savage* state may be called species, in *domesticated* races. — If all men were dead, then monkeys make men. — Man makes angels. — |

170 Those species which have long remained are those — ? Lyell[8]? — which have wide range and therefore cross and keep similar. But this is difficulty : this immutability of some species.

In Phillips,[9] p. 90, it seems the most organized fishes lived far back, first approaching to reptiles at Silurian age. — |

171 How long back have insects been known? As Gould[10] remarked to me the " beauty of species is their exactness ", but do not known varieties do the same, may you not breed ten thousand greyhounds and will they not be greyhounds? — Yarrell's[11]

[1] William Ogilby? The reference has not been traced, but John Wandesford Ogilby was Assistant Secretary to the Hudson's Bay Company from 1777 to 1780. At the London Office of the Company, Beaver House, there is a MS by Andrew Graham who was on the staff from 1750–1775 : " Observations on Hudson's Bay ", in which the following passage occurs : " a she-wolf copulated with a husky dog . . . "

[2] Antoine-Etienne-Renaud-Augustin Serres. " Anatomie des mollusques ", *L'Institut*, Paris 5, 1837, 221, p. 370.

[3] Richard Owen. Probably personal communication.

[4] Thomas Horsfield. *Zoological researches in Java and the neighbouring islands*, London 1824. *Semnopithecus pyrrhus = Presbytis cristatus*, Java. *Ursus malayanus = Helarctos m.*, Sumatra.

[5] Andrew Smith. Cf. *Variation of Animals and Plants under Domestication*, vol. 1, p. 88 : " Sir Andrew Smith several years ago remarked to me that the cattle possessed by the different tribes of Caffres, though living near each other under the same latitude and in the same kind of country, yet differed, and he expressed much surprise at the fact."

[6] John Phillips. *Treatise on Geology. Lardner's Cabinet Cyclopaedia*, London 1837.

[7] John Phillips. *A Treatise on Geology. Lardner's Cabinet Cyclopaedia*, London 1837, p. 83 : " Most of the fossil cephalopoda belong to extinct genera."

[8] Charles Lyell. No reference to this subject in Lyell's published works has been traced.

[9] John Phillips. *A Treatise on Geology. Lardner's Cabinet Cyclopaedia*, London 1837, p. 90. Fishes with placoid and ganoid scales are shown dating back to the Silurian.

[10] John Gould. Probably personal communication.

[11] William Yarrell. Probably personal communication.

remark about old varieties affecting the cross must [be] well worthy of observation.— |
172 I think it is certain strata could not now accumulate without seal-bones and cetaceans, — both found in every sea from Equatorial to extreme poles. —

Oh, Wealden, — Wealden. —[1]

Do the N. American Tertiary deposits present analogies to shells of living seas? |
173–174 *excised.*
175 A breed of Blood-Hounds from Aston Hall close to Birmingham, and supposed to be descended from a breed known to be there since the time of Charles, — and now in the possession of Mr Howard Galton have one of the vertebra, about 2/3 from
176 base of tail, enlarged here [?] | very considerably, so that any person would say the tail was broken and this came so often that it was difficult to obtain a litter without this defect. Very curious case. — W. D. Fox.[2]

When dogs are bred into each other, the females loose [lose] desire, and it is required to give the cantharides. |
177–178 *excised.*
179 Bull. Soc. Geolog., 1834, p. 217. Java Fossils : 10 out of twenty have analogues in the Indian sea. — Deshayes.[3]

Mr M'Clay[4] is inclined to think that offspring of Negro and white will return to native stock (the cross often whiter than white parent) ; the mulattos themselves
180 explain it by intermarriage with people either a little nearer black | or white as it may happen. — Dr Smith[5] says he is sure of the case at Cape. — M'Clay argues from it Black and White species. — For, says he, seeds of hybrid lillies etc. etc. (V[ide] Herbert[6] on hybrids) thus act. — Now the point will be to find whether know[n] varieties in plants do so, — as in cacti etc. etc., — as in dogs ; investigate
181 case of pidgeons, fowls, rabbits, | cats etc. etc. — When black and white men cross, some offspring black, others white, which is more closely allied to case of cross of dogs. — See Paper in Philosophic Transactions on a quagga and mare, crossing by Lord Moreton [Morton],[7] where mare was influenced in this cross to after births like aphides. — Case of boy with foetus developed in breast, — looking as if many ova
182 impreg- | nated at once. — Dr Smith[8] considers the Caffers (like Englishmen) men of many countenances, as hybrid race. Is not this contradiction to his view of races

[1] Darwin's exclamation probably refers to the problem presented by the apparently estuarine nature of the Wealden deposits and the embedding of freshwater species in them. (Cf. Lyell, *Principles of Geology*, vol. 1, London 1830, p. 134 ; vol. 2, London 1832, p. 275 ; vol. 3, London 1833, p. 325). Information kindly supplied by Mr. S. C. A. Holmes of the Geological Survey.

[2] William Darwin Fox. Probably personal communication. (Cf. *Variation in Animals and Plants*, 1868, vol. 2, p. 121.)

[3] Gérard Paul Deshayes. *Bull. Soc. Geol. France*, vol. 4, Paris [1834], p. 217 : " M. Deshayes fait connaître à la Société que M. Hardie lui ayant fait voir les fossiles qu'il a recueillis dans l'Inde, à l'île de Java, dans un terrain tertiaire très moderne, il a reconnu que, parmi les vingt espèces environ qui lui ont été communiquées, dix sont rigoureusement déterminables, et ont certainement leurs analogues dans les mers de l'Inde."

[4] William Sharp MacLeay. Probably personal communications.

[5] Andrew Smith. Probably personal communication.

[6] William Herbert. *Amaryllidaceae* : *preceded by an attempt to arrange the Monocotyledonous orders, and followed by a Treatise on cross-bred vegetables and Supplement*. London 1837.

[7] George, Earl of Morton. " A singular fact of natural history. Peculiarities of the progeny of an Arab horse from a mare that had previously bred with a Quagga." *Phil. Trans. Roy. Soc.*, 1821, p. 20.

[8] Andrew Smith. Probably personal communication.

not mingling? — In Fox's[1] case of Blood Hounds — a little mingling would probably have been good, namely such as Blood Hounds from other parts of England. |

183 Mr Bell[2] of Oxford Street had a very fine blood hound bitch which would never take the dog. But at last a rough-haired shepherd dog lined her and produced a very large litter — never afterwards went in heat. This is good instance of same fact in Mr Galton's case. — It explain[s] the loss and experience (must probably have occurred to every one) of rare breeds of dogs from owners great care of them. Fox says when two dogs of opposite breeds are crossed, sometimes offspring quite inter-

184 mediate | sometimes take strongly after either parent, about as often one way as other. — He has known case of good pointer and rough water spaniel produce litter like both parents, and Mr Bell has half blood-hound and greyhound. —

When two dogs have lined bitch directly one after the other, puppies differ, and [are] like both parents. — Fox told me of case of mare covered by blood horse and carthorse two folds [foals ?] ... |

185–190 *excised.*

191 Mr Herbert's[3] papers are in the Horticultural Transactions and a distinct work on Hybridity under title of Amaryllidae and Narcissus. Mr Donn [Don] considers Mr H[erbert] rather wild.

Mr Donn[4] [Don] remarks to me that give him a species from Ireland, England, Scotland and other localities, and each one will have a peculiar constant aspect. That is varieties, though of trifling order are formed by nature. |

192 Carmichael,[5] Tristan D'Acunha, a list of its Flora is given. Mr Don[6] remarked to me, that some good African and some good S. American forms (and on average some of these forms would have some peculiarity). — Now when we hear that the whole island is volcanic, surmounted by crater and studded with others, we see a beginning to island. Graham Island. — We know many seeds might be transported

193 some blown — floating trees. | — Thrushes (Turdus Jagonensis?) and bunting[s] (Emberiza Brasiliensis?) and coots (Fulica chloropus) might bring in stomach etc. etc. (Mem.: discover what kinds of seed these plants). (Mem.: Fact stated by Mr Don[7] in island[s]. Teneriffe, St. Helena, J. Fernandez, Galapagos. Many trees [and] compositae, because seeds first arrived and hence formed trees ; Ferns ditto), and would creator *make* plants when this volcanic point appeared in the great ocean,

194 have made | plants of American and African form, merely because intermediate

[1] William Darwin Fox. Probably personal communication.

[2] J. Bell, " of Oxford Street ". Bell, Thomas : *A History of British Quadrupeds*, London 1837, p. 209 : " The race [of blood-hounds] has been gradually diminishing, and is now very rarely to be met with in its purity. Amongst the very few instances of its present existence, I may mention a fine breed in the possession of Mr. J. Bell, of Oxford Street, who retains them in great purity." Darwin's information was no doubt transmitted personally by Mr. J. Bell.

[3] William Herbert. " Instructions for the treatment of the Amaryllis longifolia, with some observations on the production of hybrid plants." *Trans. Hort. Soc.*, vol. 3, 1820, pp. 187–196 : and " On the production of hybrid vegetables, with the result of many experiments made in the investigation of that subject ", *Trans. Hort. Soc.*, vol. 4, 1822, p. 15.

[4] George Don (junior). Probably personal communication.

[5] Captain Dugald Carmichael. "Some account of the Island of Tristan da Cunha and of its natural productions ", *Trans. Linn. Soc. Lond.*, 12, Part II, 1818, p. 483.

[6] George Don (junior). Probably personal communication.

[7] George Don. Presumably personal communication or perusal of Don's manuscript Journal in Royal Horticultural Society of London (cf. A. W. Exell : *Catalogue of the Vascular plants of S. Tomé*, London B.M. (N.H.), 1944, p. 8.

position. — We cannot consider it as adaptation because volcanic islands whilst African sandstone and granite (that is genera near Cape), see if there are any species same as T. del Fuego and C. of Good Hope, show *possibility* of transport. If some cannot be explained more philosophical to state we do not know how transported. |
195 (Glaciers might have acted at Tristan D'Acunha. — Carmichael,[1] Linn. Transacts., Vol. XII. —)

The alpine plants of the Alps must be new formations because snow formerly descended lower, therefore species of lower genera altered, or northern plants.

Mem. The antarctic flora must formerly have been separated by short space from mountains low down, therefore plants common ; take an example from T. del Fuego. |
196 Ellis[2] (?) says Tahitian kings would hardly produce from incestuous intercourse, — a parallel fact to Blood Hounds.

Before attraction of gravity discovered it might have been said it was as great a difficulty to account for movement of all [planets] by one law,[3] as to account for each separate one ; so to say that all mammalia were born from one stock, and since distributed by such means as we can recognize, may be thought to explain nothing, — it being as easy to produce for the creator two quadrupeds at S. America — jaguar and Tiger. |

197–202 *excised.*

203 When species cross and hybrid breed, their offspring show tendency to return to one parent ; this is only character, and yet we find this same tendency (only less strongly marked) between what are called varieties. NB. One mother bringing forth young having very different characters is attempt at returning to parent stock. I think we may look at it so — ?? It holds good even with trifling differences of expression — one child like father, another like mother. |

204 Has Lowe[4] written any other paper besides one in Latin, one on Madeira — any general observation. Difference of species between land shells of Porto Santo and Madeira. I believe very curious.

My idea of propagation almost infers, what we call improvement. All mammalia from one stock, and now that one stock cannot be supposed to be most perfect
205 (according to our ideas of perfection), but intermediate | in character. The same reasoning will allow of decrease in character (which perhaps is case with fish, as some of the most perfect kinds the shark. Lived in remotest epochs). — ? Lizards of secondary period in same predicament. It is another question whether whole scale of Zoology may not be perfecting by change of Mammalia for Reptiles which can
206 only be adaptation to changing world. — I cannot for a | moment doubt but what cetacea and Phocea now replace Saurians of Secondary epoch : it is impossible to suppose such an accumulation at present day and not include Mammalian remains. The Father of all insects gives same argument as father of Mammalia, but here

[1] Captain Dugald Carmichael. *See* above p. 64.

[2] William Ellis. *Polynesian researches, during a residence of nearly eight years in the Society and Sandwich Islands*, London 1831.

[3] This is the first appearance of the argument used by Darwin in the *Sketch* of 1842, p. 84 ; and the *Essay* of 1844, p. 250.

[4] Richard Thomas Lowe. " Primitiae Faunae et Florae Maderae et Portus-Sancti ; sive Species quaedam novae vel hactenus minus rite cognitae animalium et plantarum in his insulis degentium breviter descriptae ", [1830] *Trans. Camb. Phil. Soc.*, vol. 4, 1833, p. 1.

improvement in system of articulation. ? Whether type of each order may not be supposed that form, which wandered least from ancestral form. If so are present
207 typical | species most near in form to ancient ; in shells alone can this comparison be instituted. —

People often talk of the wonderful event of intellectual man appearing. The appearance of insects with other senses is more wonderful. — Its [the insect's] mind more different probably and introduction of man nothing compared to the first thinking
208 being — although hard to draw line, | not so great as between perfect insects and forms low hard to tell whether articulate or intestinal, or even a mite. — A bee compared with cheese mite — with its wonderful instincts. The difference is that there is wide gap between man and next animals in mind more than in structure.

If the skeleton of a negro had been found, what would anatomists have said? — ? Where is Pentland's[1] account of . . . |

209–210 *excised.*

211 A. B. C. D. (A) crossing with (B), and (B) being crossed with (C) prevents offspring of A becoming a good species, well adapted to locality. But it is instead a stunted and diseased form of plant, adapted to A. B. C. D. Destroy plants B. C. D. and A will soon form good species!

The increased fertility of slightly different species and intermediate character of offsprings accounts for *uniformity* of species and we must confess, that we cannot
212 tell, what is the amount | of difference which improves and checks it. — It does not bear any precise relation to structure. Mem.: Eyton's[2] hogs and dogs.

The passage in last page explains that between species from moderately distant countries there is no test but generation (but experience according to each group) whether good species, and hence the importance naturalists attach to geographical ranges of species. |

213 Definition of species : one that remains at large with constant characters, together with other beings of very near structure. — Hence species may be good ones and differ scarcely in any external character. For instance, two wrens, found to haunt two islands — one with one kind of herbage and one with other — might change organization of stomach and hence remain distinct. |

214 When country changes rapidly, we should expect most species. —

The difference [between] intellect of man and animals not so great as between living thing without thought (plants) and living thing with thought (animal).

∴ My theory very distinct from Lamarck's.[3]

Without *two* species will generate common kind, which is not probable, then
215 monkeys will never produce man, but | both monkeys and man may produce other species. Man already has produced marked varieties and may someday produce something else, but not probable owing to mixture of races. — When all mixed

[1] Joseph Barclay Pentland. Probably " Decription of fossil remains of some animals from the northeast border of Bengal ", *Proc. Geol. Soc.*, vol. 1, 1834, p. 76.

[2] Thomas Campbell Eyton. " Some Remarks upon the Theory of Hybridity ", *The Magazine of Natural History*, N.S., vol. 1, London 1837, p. 357.

[3] Darwin's point appears to be that Lamarck placed a great distinction between the higher animals which possessed a " sentiment intérieur ", and the lower animals which do not. (*Philosophie Zoologique*, Paris 1809, vol. 2, p. 256).

physical changes (? intellectual [faculty] being acquired alters case) other species or angels produced. |

216 Has the Creator since the Cambrian formation gone on creating animals with same general structure. — Miserable limited view. —

With respect to how species are [formed], Lamarck's[1] "willing" doctrine absurd (as equally are arguments against it[2] — namely how did otter live before being made

217 otter — why to be sure there were a thousand intermediate | forms. — Opponent will say : show them me. I will answer yes, if you will show me every step between bull Dog and greyhound). I should say the changes were effects of external causes, of which we are ignorant, as why millet seed turns a Bullfinch black, or iodine on glands of throat, or colour of plumage altered during passage of birds (where is this statement? — I remember L. Jenyns[3] talking of it), or how to make Indian cow with hump or pig's foot with cloven hoof. |

218 Ask Entomologists whether they know of any case of *introduced* plant, which an insect has become attached to, that insect not being called omniphitophagous.

But it will be said there are latent insects [instincts], — as crows against man with gun, and Bustards etc. etc.!!!

An American and African form of plant being found in Tristan D'Acunha, may be said to deceive man, as likely as fossils in old rocks for same purpose! |

219 Can the wishing of the Parent produce any character in offspring? Does the mind produce any change in offspring? If so, adaptation of species by *generation* explained?

NB. Look over Bell[4] on Quadrupeds for some facts about dogs etc. etc. — NB. Animals very remote — ass and horse — produce offspring exactly intermediate. — Reference to Pig and Dogs.

My theory will make me deny the creation of any new quadruped since days of Didelphis in Stonesfield ∴ all lands united (Falkland Fox, ice). Mauritius — what a difficulty, when elevated, subsidence near is only hope. — New Zealand, compare to Van Diemen's land, glorious fact of *absence* of quadrupeds. — East India Archipelago, very good on opposite tendency. — |

220 Study Ellis and Williams [William Ellis][5] Zoology of South Sea islands — any animals [mammals]? I believe — none. — Canary islands? Madeira? Tristan D'Acunha? Iceland?

The connection between Mauritius and Madagascar very good. — Fernando Po and Coast of Africa equally good. — Small islands off New Guinea — same fact, see Coquille's Voyage. — Galapagos mouse (?) — brought by canoes. — Ceylon and India. — Van Diemen's Land — Australia. — England and Europe. — It will be well worth while to study profoundly the origin and history of every terrestrial mammalia, especially moderately large ones. — |

[1] Jean Baptiste de Lamarck. *See* Introduction.

[2] Darwin means that arguments against the formation of species are absurd. The argument about the evolution of the otter through intermediate forms is developed in the *Essay* of 1844, p. 152.

[3] Leonard Jenyns, afterwards Blomefield. Probably personal communication.

[4] Thomas Bell. *A History of British Quadrupeds*, London 1837 ; pp. 194 to 251 are devoted to the breeds of dogs.

[5] William Ellis. *Polynesian researches, during a residence of nearly eight years in the Society and Sandwich Islands*, London 1831.

221 In the Flora of Tierra del Fuego, like that of North Europe, many genera and few species.

The number of genera on islands and on Arctic shores evidently due to the chance of some ones of the different orders being able to survive or [to] chance having transported then to new station. — When the new island splits and grows larger, species are formed of those genera, and hence by same chance few representative species. This must happen and then enquire [enquiry] will explain representative system.

Of these we see example in English and Irish Hare. — Galapagos shrews and when
222 big continent, many species belonging to its own genera. | Therefore if in small tract we have many species, we may insure mass continental or many large islands. — Hence this must have been condition of Paris basin land. — How is this with Fernando Po, with plants of St. Helena and Tristan D'Acunha? — resolves itself into question of proportion of species to genus.

If on one island several species of same genus — subsided land. — Mauritius? Although the horse has perished from S. America, the jaguar has been left and Fox
223 and bear. — If I had not discovered | channel of communication by which great Edentata might have roamed to Europe and Pachydermata from Europe to America, how strange would presence of jaguar [have] been in S. America. —

West coast of Africa and East of America ought to present great contrast in forms ; India intermediate ; see how that is. — ? Are shell-boring Mollusca like Carnivorous mammalia in their wide range and in their duration of species. (? Are carnivorous mamm[alia] in Paris basin altered ? perhaps more like present carnivora than Pachydermata.) |

224 If my theory true, we get 1st a *horizontal* history of earth within recent times, and many curious points of speculation ; for having ascertained means of transport, we should then know whether former lands intervened. — 2^{d}) By character of any two ancient fauna, we may form some idea of connection of those two countries. Hence India, Mexico and Europe — one great sea. (Coral reefs ∴ shallow water at Melville island). 3^{d}) We know that structure of every organ in A.B.C., three species of one genus can pass into each other by steps we see ; but this cannot be predicated
225 of structures in two genera. Although D.E.F. follow close to | A.B.C., we cannot be sure that structure (C) could pass into (D). — We may foretell species, limits of good species being known. It explains the blending of two genera. — It explains typical structure. — Every species is due to adaptation hereditary structure ; Latter far chief element. ∴ Little service habits in classification or rather the fact they are *not* far the most serviceable. We may speculate on durability of succession from what we have seen in old world and in current changes which may happen. —

It leads you to believe the world older than *geologists* think ; it agrees with exces-
226 sive inequality of numbers of species in divisions, — look at articulata!!? | It leads to [knowledge of] nature of physical change between one group of animals and a successive one. — It leads to knowledge what kinds of structure may pass into each other ; now on this view no one need look for intermediate structure, say in brain, between lowest mammal and reptile (or between extremities of any great divisions) ; thus a knowledge of possible changes is discovered, for speculating on future. |

227 ∴ Fish never become a man. — Does not require fresh creation. — If continent had sprung up round Galapagos on Pacific side, the Oolite order of things might have early been formed. —

With belief of transmutation and geographical grouping we are led to endeavour to discover *causes* of changes, — the manner of adaptation (wish of parents??), instinct and structure becomes full of speculation and line of observation. — View of generation being condensation, test of highest organization intelligible. — May
228 look to first germ, | led to comprehend true affinities. My theory would give zest to recent and fossil Comparative Anatomy ; it would lead to study of instincts, heredity and mind heredity, whole [of] metaphysics. — It would lead to closest examination of hybridity, — to what circumstances favour crossing and what prevent it ; and generation, causes of change in order to know what we have come from and to what we tend, this and direct examination of direct passages of structure in species might lead to laws of change, which would then be [the] main object of study,
229 to guide our speculations | with respect to past and future.

The grand question which every naturalist ought to have before him when dissecting a whale, or classifying a mite, a grampus or an insect is What are the Laws of Life?

When we have near genera far back as well as at present time, we might expect confusion of species. — Important. For instance, take Voluta and Conus (??), which now near together, were not both genera formerly abundant.

Seed of Ribston Pippin tree producing crab [apple] is the offspring of a male and female animal of one variety going back? Whether this going back may not be owing to cross from other trees???? |

230 Do the seeds of Ribston Pippin and Golden Pippin produce real crabs, and in each case similar or mere mongrels?

It really would be worth trying to isolate some plants under glass bells and see what offspring would come from these. Ask Henslow[1] for some plant, whose seeds go back again, not a monstrous plant, but any marked variety. — Strawberry produced by seeds?? — Universality of generation strongly shown by hybridity of ferns. — Hybridity showing connexion of two plants. |

231 Animals whom we have made our slaves we do not like to consider our equals. — Do not slave-holders wish to make the black have other mind? — Animals with affection, imitation, fear of death, pain, sorrow for the dead — respect.

We have no more reason to expect the father of mankind, than Macrauchenia, yet it may be found. — We must not compare chance of embedment in man in present state with what he is as former species. His arts would not then have taken him over whole world. — |

232 The soul by consent of all is superadded, animals not got it, not look forward. If we choose to let conjecture run wild, then animals — our fellow brethren in pain, disease, death, suffering and famine, our slaves in the most laborious works, our companions in our amusements, — they may partake from our origin in one common ancestor, we may be all netted together. —

Hermaphrodite animals couple : argument for true molluscs coupling. — |

233–234 *excised.*

[1] John Stevens Henslow.

235 Geograph. Journal, Vol. V, P. I, p. 67. Dr Coulter[1] on decrease of population in California [by the] cessation of female offspring : applicable to any animal.

Athenaeum, p. 154, 1838. Hybrid Ferns.[2]

It may be argued against theory of changes that if so, in approaching desert country or ascending mountain you ought to have a gradation of species, now this 236 notoriously is | not the case. You have stunted species, but not such as would make species (except perhaps in some plants, and then a chain of steps as found in some mountains). — How is this explained by law of small differences producing more fertile offspring. — I[ly] All variation of animal is either effect or adaptation, ∴ Animal best fitted to that country where change has taken place. Nature. . . . | 237–238 *excised.*

239 Any change suddenly acquired is with difficulty permanently transmitted. A plant will admit of a certain quantity of change at once, but afterwards will not alter. This need not apply to very slow changes without crossing. — Now a gradual change can only be traced geologically (and then monument imperfect) or horizontally, and then cross breeding presents perfect change. |

240 It is scarcely possible to get evidence of two races of plants run wild. — (For we know that such can take place without impregnating each other). For if they are different, then they will be called species, and these producing fertile hybrids will not destroy that evidence, as so many plants produce hybrids, or else whole fabric will be overturned. — Hence extreme difficulty, argument in circle. — Falkland Island case good one of animals not soon being subjected to change in Americas. 241 Perhaps merely gone back previous | to fresh change. —

Get a good many examples of animals and plants very close (take European birds Mr Gould's[3] case of willow wren and other varying in wild state to show that we do not know what amount of difference prevents breeding, or as others would express it amount of varying in wild state. —

When breaking up the primeval continent, — Indian Rhinoceros, Java and Sumatra ones all different. — Join Sumatra and Java together by elevations now in Pro- 242 gress, and you will have two | Tapirs existing in East Indian seas. Marsupial animals all show greater connexion in Quadrupeds, but *plants do not follow* by any means. — Ostriches. — Hippo[po]tamus only african. — American and African forms mingle in India and East Indian islands. — Monkeys different not travellers??

Royle's[4] case of Himalayan plants. ? Migrating birds. He told me some story of crane from Holland!!! In stomach or in feathers — seeds. — |

243 Two inhabitants of the tropics (whether one fossil or not) are related by real relationship, as well as effect of similar temperature. — Now those of temperate

[1] Thomas Coulter. " Notes on Upper California ", *Journ. Roy. Geogr. Soc.*, vol. 5, 1835, p. 59. On p. 67 : " It is a very extraordinary fact that their [the Indians'] decrease is greatly hastened by the failure of female offspring, — or the much greater number of deathe amongst the females in early youth than in the males."

[2] Martin Martens. " On hybridity in ferns ", (Paper read before Botanical Society on 16th February 1838). *The Athenaeum*, 1838, p. 154.

[3] John Gould. *The Birds of Europe*, London 1837, vol. 2, (pages unnumbered). P. 131 : " A little variation frequently occurs in the size of each of the birds ".

[4] John Forbes Royle. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains*, London 1834–1835.

regions and tropics are only related by one connection — viz. descent. — Hence far greater discordance in latter. Hence change in form. — This probably explains crag and miocene. — The descendants left in cooling climate might change twice over, whereas those which migrate a little to the southward would merely be specifically different if so. — Now this is difficult to explain by creation or we must suppose a
244 multitude of small creations. — | Will Dromedaries and Camels breed? — As man has not had time to form good species, so cannot the domesticated animals with him ! —

Modern origin shown by only one species far more than by non-embedment of remains — ? agrees with non-blending of languages ? —

Till man acquired reason, he would be [a] limited animal in range, and hence probability of starting from one point. — |

245 In the crag we see the process of change of those forms, which have succeeded in becoming habituated to colder climate, whilst others died out or moved towards equator, or some species might then have been wanderers. —

There ought to be fewer species in proportion to genera, than in present seas. All the species which survives any change may undergo indefinite change (making in their history an eocene, miocene and pliocene epoch), whilst others may die out or move southward.

246 ∴ Species must be compared | to neighbouring sea. — For change of species does not measure time but physical changes (We assume like weather on long average tolerably uniform). — Comparing fossils with whole world, would be like in a palaeontologic table in comparison of temperature of two countries, finding a very hot day in one, oh we will take a day from the equator to add to the mean of the other. |

247 If the world had cooled by secular refrigeration in chief part instead of change from insular to extreme climate, Iceland and North of Europe would have possessed a most peculiar Flora. — As European forms have travelled towards Equator, so would the plants from extreme north, which according to all analogy would have been very unlike southern European ones, — " a variation played on secular refrigeration ". |

248 Experimentise on land shells in salt water and lizards ditto. — Ask Eyton[1] to procure me some. Get Hope[2] to give me an account of parasitic animals of beast varying in different climates.

Those will not object to my theory, those the philosophers who soar above the pride of the savage, they perceive the superiority of man over animals, without such resorts. |

249–250 *excised.*

251 Duméril[3] great work on Reptiles. M. D says some reptiles same from Mauritius and Madagascar and C. of Good Hope. — His book probably worth studying. —

Wingless birds [of] S[outh] continents. Ostriches. Dodo. Apteryx. Penguin. —

[1] Thomas Campbell Eyton.
[2] Frederick William Hope.
[3] André-Marie-Constant Duméril. *Erpétologie générale ou Histoire complète des Reptiles.* Paris 1836, p. 278 : " Parmis ces cinq dernières espèces Africaines [de Platydactyles], une a pour patrie commune le Cap de Bonne Espèrance, Madagascar et Maurice."

Logger-headed Duck. — Large proportion of Water and small of land — or few quadrupeds. —

Study production of great Fresh Water lakes of North America. |

252 If Parasites different, whilst man and his domesticated quadrupeds are not so, greater facilities of change in the articulata, than in Vertebrata. But how does this agree with longevity of species in Molluscs!!!

When we talk of higher orders, we should always say intellectually higher. — But who with the face of the earth covered with the most beautiful savannahs and forests dare to say that intellectuality is only aim in this world. |

253–260 *excised.*

261 Of genera in all classes are not a few only cosmopolitan, and in genera peculiar to any one country do not species generally affect different stations ; This would be strong argument for propagation of species. — Again is there not similarity even in quite distinct countries in same hemisphere more than in other. |

262 Are there any cases where domesticated animals separated and long interbred having great tendency to vary? Is not man thus circumstanced? Varieties of dogs in different countries a case in point. — All cases like Irish and English Hare bear upon this. — |

263 Why do Van Diemen's land people require so many imported animals? —

At what point of tree of life can orders like birds and animals [mammals] separate etc. etc.

Work out Quinary system according to three elements. |

264 How is Fauna of Van Diemen's land and Australia? |

265–271 *blank.*

272 Falconer's[1] remarks on influence of climates, situations etc. etc. 242 Hook.

Smellie,[2] Philos. of Zoolog. 842

Poor Tract Lyell.

White[3] regular gradat. in man 1024.

Fleming's[4] Philosophy of Zoolog.

Royle[5] on Himalaya Plants. — |

273 Would it not be possible to work through all genera and see how many confined to certain countries. So on with families. — Ask Royle[6] about Indian cattle with humps. — |

274 ? To be solved if horses sent to India and long bred in and no new ones introduced, would not change be superinduced. — Why is every one so anxious to cross animals from different quarters to prevent them taking peculiar character. Indian Bull? — |

275 Do species of any genus, as American or Indian genus inhabit different kind of localities? — if so, change.

[1] Hugh Falconer. "On the Aptitude of the Himalayan Range for the Culture of the Tea Plant", *J. Asiatic Society of Bengal*, Calcutta 1834, vol. 3, p. 178.

[2] William Smellie. *The Philosophy of Natural History*, Edinburgh & London 1790, 1799.

[3] Charles White. *An account of the regular gradation in Man, and in different animals and vegetables*, London, 1799.

[4] John Fleming. *The Philosophy of Zoology*, Edinburgh & London 1822.

[5] John Forbes Royle. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains*, London 1834–1835.

[6] John Forbes Royle. Cf. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains*, London 1839, p. lxxiv.

THE GRAND QUESTION : Are there races of plants run wild or nearly so, which do not intermix, — any cultivated plants produced by seed. — Lychnis. — Flox. — |

276 Read Swainson.[1] |

277 *blank.*

278 In production of varieties is it not per saltum —

Islands bordering continents — same type. Collect cases. — African islands. — How in Juan Fernandez ? Humming-Birds.

Types of former dogs. Character of Miocene Mammalia of Europe. |

279 Mem. Mr Bell's[2] case of *Sub-Himalayan* land emys decidedly an Indian form of Tortoise. — On other hand, freshwater tortoise from Germany[3] (where Mr Murchison's[4] fox was found) decidedly next species to some South American kinds. — |

280 Are the closest allied species always from distant countries, as Decandolle[5] says? (no, he only says — sometimes). We might expect disseminated species to say a little, but such should not be general circumstance. — In insects, in England, surely it is not — intermediate genera we might expect. — |

281 Lindley[6] Introduction.

Dict. Science Naturelle.[7]

Géographie Botanique. De Candolle.[8] Geol. Soc.

Horae Entomologicae.[9]

Linn. Soc.

Geoffr. St. Hilaire Philosophy of Zoology.[10] Waterhouse.

[1] William Swainson. *A Treatise on the Geography and Classification of Animals. Lardner's Cabinet Cyclopaedia*, London 1835.

[2] Thomas Bell. *Proc. Zool. Soc. Lond.*, Part II, 1834, p. 17. " Specimens and drawings were exhibited of a *freshwater Tortoise*, forming part of the collection of Mr. Bell, by whom it was described as a type of a new genus, for which he proposed the name of *Cyclemys*." " Mr. Bell regards the *Tortoise* which he has thus characterized as supplying a link in the connecting series of the *land* with the *freshwater* families which has hitherto been wanting. . . . "

[3] Thomas Bell. " Zoological observations on a new Fossil Species of Chelydra, from Oeningen." [1832], *Trans. Geol. Soc.*, vol. 4, 1835, p. 379.

[4] Roderick Impey Murchison. " On the fossil fox of Oeningen, with an account of the lacustrine deposit in which it was found," *Proc. Geol. Soc.* 1826–1833, vol. 1, p. 167 ; *Trans. Geol. Soc.*, vol. 3, 1835, p. 277.

[5] Augustin-Pyramus de Candolle. *Essai élémentaire de géographie botanique*, Strasbourg, 1820.

[6] John Lindley. *An Introduction to the Natural System of Botany*, London 1830.

[7] *Dictionnaire des sciences naturelles, dans lequel on traite méthodiquement des différens Etres de la nature*, edited by F. Cuvier with a prospectus by Georges Cuvier, Paris & Strasbourg 1816–1830.

[8] Augustin-Pyramus de Candolle. *Essai élémentaire de geographie botanique*, Strasbourg 1820.

[9] William Sharp MacLeay. *Horae Entomologicae*, London 1819–1821.

[10] Etienne Geoffroy-Saint-Hilaire. *Principes de philosophie zoologique*, Paris 1830.

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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

PART II

Edited with an Introduction and Notes by

SIR GAVIN DE BEER

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PART II. SECOND NOTEBOOK (FEBRUARY TO JULY 1838)

INTRODUCTION

IN his First Notebook on Transmutation of Species,[1] Darwin satisfied himself that it had occurred when populations were isolated and no longer able to prevent the variation that resulted from sexual reproduction and is normally kept in check by breeding throughout the population. In this way varieties become split off from species and eventually become species themselves, while old species become extinct, thereby increasing the separation between the surviving species, many of which after being split into daughter species become genera. This was what Darwin meant by " my theory ", and it was already distinctively his even before he thought of natural selection because nobody before him had combined genetic variation, isolation, divergence, and extinction into a coherent theory of transmutation of species.

In his Second Notebook, which represents Darwin's train of thought from the beginning of February to the first half of July 1838, he was already concerned with the problem of expressing his views on paper and gave himself instructions for presenting his theory. He had even thought out how he would start : " The only cause of similarity in individuals we know of is relationship, children of one parent, races of animals—argue opening thus " (II 219)[2] ; " The argument [that two varieties of old standing will not breed together] must thus be taken as in wild state " (II 30). In the event he started very differently as the *Sketch* of 1842 shows. Other instructions covered the different aspects of the argument : " Give specimen of arrangement " of species in relation to geographical distribution (II 45) ; Discrimination between species is empirical : " show this by instances " (II 70) ; " Mention persecution of early astronomers " (II 123) ; " Argue the case theoretically if animals did change excessively slowly whether geologists would not find fossils such as they are " (II 137) ; "Put note Sir W. Scott has written about" recalling images long past (II 172) ; John Gould's conviction that half-breed of Australian dog would be most like Australian " might be mentioned in note " (II 189). An especially awkward problem was the origin of instincts : " my theory must encounter all these difficulties " (II

[1] " Darwin's Notebooks on Transmutation of Species. Part 1, First Notebook." *Bull. Brit. Mus.* (*Nat. Hist.*), Historical Series, vol. 2, pp. 23–73, 1960.

[2] References are given to the number of the Notebook and the manuscript page number.

199). Most important, he felt, was the following warning which shows that he was already alive to possible objections: " I fear great evil from vast opposition in opinion on all subjects of classification, I must work out hypothesis & compare it with results; if I acted otherwise my premises would be disputed " (II 202).

Among the claims which he was already able to make for " my theory " were the following: " My theory agrees with unequal distances between species " (II 145); " My theory explains that family likeness . . . holds good " (II 138); " My theory explains a grand apparent anomaly in nature " i.e. the existence of mules (II 135); " State broadly scarcely any novelty in my theory, only slight differences, the opinion of many people in conversation. The whole object of the book is its proof " (II 177).

One of the pillars of " my theory " was the principle of Community of descent and its consequences. " We now know what is the natural arrangement. It is the classification of relationship, latter word meaning descent." (II 155); " The one end of classification [is] to express relationship and by so doing discover the laws of change in organization " (II 158).

Darwin's recognition of the community of language of different species of birds in cries of distress (II 68) anticipated by 120 years the modern demonstration of the fact by electrical recordings[1].

Taxonomy acquired a completely new significance as a result of " my theory ", and it is remarkable how Darwin's views anticipated modern conclusions. He recognized the principle that two similar but separated populations should not be regarded as distinct species until the regions between their ranges have been studied. Populations which overlap in their ranges but maintain their distinct characters can be regarded as good species (II 126). Therefore, a traveller " will not have brought home new species until he can show range and habits " (II 127).

For Darwin, species and genera had real existence in Nature. " Genus must be a true cleft putting out of case the analogy [of its species breeding with those of another genus]. If genus does not mean this it means nothing. There should be some term used where there is series " (II 129). This is Rensch's *Artenkreis*. As for the origin of genera, " Genus only natural from death or slow propagation of forms—just same way as men not all equally related to each other " (II 138); " The death of some forms & succession of others . . . is absolutely necessary to explain genus and species " (II 167).

Darwin soon saw that the onset of sterility was an essential factor in the origin of new species: " One species may have passed through a thousand changes, keeping distinct from other, and if a first and last individual were put together, they would not . . . breed together " (II 152). The geographical equivalent of this effect of passage of time is to be found in the British Herring Gull and Lesser Black-backed Gull. Darwin, however, had no evidence to support his view. Hence: " The most hypothetical part of my theory [is] that two varieties of many ages standing will not readily breed together " (II 30). This may be compared with T. H. Huxley's *caveat* that Darwin had not proved his point until he could show that natural selection had led to sterility between divergent products of evolution. Darwin realized this diffi-

[1] *cf.* " Developments in the study of animal communications " by P. Marler, in *Darwin's Biological Works*, edited by P. R. Bell, Cambridge 1959, pp. 150–206.

culty even before he had formulated his theory of natural selection. Meanwhile he investigated the possibility that the half-way stage to sterility is represented by sterile hybrid offspring (II 222), and concluded that " My views which would even lead to anticipate mules is very important for Lyell said to me the fact of existence of mules appeared to him most strange . . . my theory then explains a grand apparent anomaly in nature " (II 135).

The effects of " my theory " on the position of man was already realized : man " Likes to think his origin god-like " (II 155) ; " Not a deity " (II 77). Comparative pathology is invoked to good effect : " Many diseases in common between man and animals " (II 174).

Darwin's abhorrence of slavery is reflected in the following : " White man who has debased his nature by making slave of his fellow black " (II 154). Sexual selection is applied to man as well as to animals : " Cock birds attract female by song (analogy of man) " (II 178). Man is compared with the orang utan (II 79), and with other Primates : " A man grinning is to expose his canine teeth (this may be made a capital argument if man does move muscles for uncovering canines), no doubt a habit gained by formerly being a baboon with great canine teeth " (II 243) ; " Man in his arrogance thinks himself a great work worthy the interposition of a deity. More humble and I believe truer to consider him created from animals " (II 196).

The prevailing total ignorance of the causes of variation was a constant worry to Darwin. Always bearing adaptation in mind, he could only conclude : " Till we know uses of organs clearly, we cannot guess causes of change " (II 56). He was reduced to wrestling with William Yarrell's view that the oldest variety has the greatest effect on offspring in a cross (II 1), but was careful to remind himself to " give it " as Yarrell's theory. Later, (II 121) he gave it up. The difference between sports (or mutations) which were already recognized as inherited and minor variability which was so important for transmutation by imperceptible steps led Darwin to believe that there were " Two kinds of varieties. One approaching to nature of monster, [is] hereditary, [the] other [is] adaptation " (II 4).

Darwin already realized clearly that adaptation was a phenomenon of varying efficiency and that organisms could be imperfectly adapted to their environment (I 115, 130).

In one striking passage he anticipated the principle of the phenocopy : "If puppy born with thick coat [in temperate climate it is] a monstrosity, [but if the puppy is] brought into a cold country and [a thick coat] is then acquired, then [it is an] adaptation " (II 66). Admission of possible imperfection in Nature is shown in the following ; " Even a deformity may be looked at as the best attempt of nature under very unfavoured conditions as an adaptation " (II 65). He realized that the phenomenon of the ptarmigan and hare becoming white in winter are not caused by the direct effect of the environment by physical action, but are instances of adaptation (II 84), and this example shows how closely variation and adaptation were associated in his mind. " The wonderful power of adaptation given to organization. This [is] really perhaps greatest difficulty to whole theory " (II 175). The recognition of adaptations often requires ingenuity, as in the following case : " Wax of ear bitter, perhaps to prevent insects lodging there " (II 174).

It was the fact of anomalies of geographical distribution that first brought Darwin up against the problem of transmutation. He soon saw that the distribution of large mammals was significant: " There is this great advantage in studying geograph: range of quadrupeds; that either created in each point, or migrated from those quarters where we know quadrupeds have existed for ages " (II 29). Geographical distribution introduced the possibility of isolation of groups on a grand scale: " Have the Edentata and Marsupials forms been chiefly preserved where shut up by themselves without other animals? " (II 36); " How came it animals not preserved in Central S. America and yet in Africa and India? " (II 132). Related representative species in different regions interested him greatly: " Buzzards in Patagonia and in Chile a good case of replacement " (II 56); " Once grant my theory and the examination of species from distant countries may give thread to conduct to laws of change of organization " (II 70).

Darwin realized that if species had not been separated and specially created, there must have been a mechanism of evolution. Before he hit upon the principle of natural selection his views on this problem could not be very precise, but the notion of competition appears in the following passage, albeit without defined penalties for the losers: " Once grant that species and genus may pass into each other, grant that one instinct to be acquired (if the medullary point in ovum has such organization as to force in one man the developement of a brain capable of producing more glowing imagining or more profound reasoning than other, if this be granted) and whole fabric [of special creation of species] totters and falls " (II 76). The penalties make their appearance in the following: " The constitution being hereditary and fixed certain physical changes [in the environment] at last become unfit [for the organism] the animal cannot change quick enough and perishes " (II 153). He also wondered " Whether species may not be made by a little more vigour being given to the chance offspring " (II 61). Isolation is part of the mechanism: " Nature conscious of the principle of incessant change in her offspring has invented all kinds of plan to insure sterility, but isolate your species [and] her plans are frustrated " (II 53).

It has not been explained how and why Darwin adopted a mechanistic viewpoint at a time when religious orthodoxy permeated science and philosophy, but there is no mistaking it in the following passages: " Why is thought being a secretion of brain, more wonderful than gravity a property of matter? " (II 166). He even referred to mental processes as " machinery ": Animals " can reason but man has reasoning power in excess. Instead of definite instincts his is a replacement in mental machinery so analogous to what we see in bodily that it does not stagger me " (II 78). The following remark needs no comment: " Love of the deity effect of organization, oh, you materialist! " (II 166). All the more remarkable is it to find Darwin giving voice to a view which Malthus would have rejected as anathema: " Educate all classes, avoid the contamination of caste, improve the women (double influence) & mankind must improve " (II 220).

Although the Second Notebook on Transmutation of Species was started in the beginning of February 1838 and finished in July of the same year, Darwin added lists of books to be read and read at dates subsequent to July 1838. Among these books under the date 3 October, is listed Malthus on Population, which enables the

date when Darwin read that book " for amusement " to be determined with precision. The significance of this information will be pointed out in the Introduction to the Third Notebook on Transmutation of Species.

As in the other Notebooks, a number of pages (102) were cut out by Darwin in 1856 when he began to write the work of which the *Origin of Species* was an abstract.

Darwin's Second Notebook on Transmutation of Species, also known as Notebook " C ", is Darwin MS 122 in the Cambridge University Library, to the authorities of which acknowledgement is warmly made for their unfailing assistance and courtesy.

I am also deeply obliged to Dr. Sydney Smith for his kind criticism and help.

Inside front cover

CHARLES DARWIN

written between (begining of February & July 1838)
. . . two pidgeons which cross & keep colour on wing. Effects of colour on parent. white room. How are varieties . . . ? Books about amount of difference when hybrids produced have any close species ever yet failed. About trades affecting form of man. Could you get racehorse from cart horse . . .

All good References selected Dec 13 1856. Also worked through April 23 1873. |

1 Mr Yarrell[1] give it as his theory tells me he had no doubt that oldest variety takes greatest effect on offspring. Thus presuming those varieties to be oldest which have long been known in any country, he states that Esquimaux dog when crossed with pointer produced offspring much nearer Esquimaux than Pointer. — He has no doubt that same thing would happen with Australian dog & any of our common
2 varieties. He has ditto doubt that | chestnut for many generations back was crossed with Bay mare, only by a few generations, that offspring would be chestnut. — On this principle I may add, that fact of half cross with parents, going back to either parent, is lucidly explained. — Mr. Yarrell states that if any odd pidgeon crossed with common pidgeon, offspring must be like latter, because oldest variety. — He
3 says of two varieties of | pidgeon, although having skulls so different, that they would be called genera, yet retain marking of wings like the wild rock pidgeon. — Fact analogous to Owen's[2] Phil. remark of Apteryx having feathers. — It is possible time being an element in the transmission of form may explain mule and pig being half way. Yet dogs sometimes like father, sometimes like mother. The fact of |
4 great monstrosities being produced, & handed down with ease, is analogous to what occurs in plants. — All these facts clearly point out two kinds of varieties. — One approaching to nature of monster, hereditary, other adaptation. — Mr. Yarrell says, that after breeding in pidgeons with very much care that it requires the greatest difficulty to rear them, eggs hatched under other birds & brought up by hand. These facts all account for |

5–14 *excised.*

15 Birds of Australia. Many in common ? species ? with New Guinea. — Many kinds common to New Guinea & rest of isle in E. Indi: Arch: In New Zealand a Sturnus of American form, a Synallaxis ? American ? p. 159 & 160 162 list of some birds of Tingetabou & New Ireland.[3] — Gould[4] will hereafter know about birds of

[1] William Yarrell (1784–1856).

[2] Richard Owen. " On the anatomy of the Southern Apteryx." Communicated April 10, 1838, *Trans. Zool. Soc. Lond.*, vol. 2, 1841, p. 257. On p. 258 :—" The Apteryx presents such a singular and seemingly anomalous compound of characters belonging to different orders of Birds, . . . It seems, as it were, to have borrowed its head from the Longirostral Grallae, its legs from the Gallinae, and its wings from the Struthious order. It is clothed with a plumage having the characteristic looseness of that of the terrestrial birds deprived of the power of flight . . . " Presumably Darwin heard Owen deliver this paper or discuss it beforehand.

[3] Jean-René-Constantin Quoy, et Joseph-Paul Gaimard. *Voyage de dècouvertes de l'Astrolabe. Zoologie.* Paris 1830, p. 159 :—" La Nouvelle-Irlande a plusieurs genres d'oiseaux qui lui sont communs avec la Nouvelle-Guinée dont elle est si voisine."

[4] John Gould (1804–1881).

N. Zealand.[1] L'Institut 1838. A Dipus & other rongeur in Australia. — p. 67 ? American forms ? An Infusorian not extinct species.[2] good Resumé ditto p. 62 ??? |
16 Age of Deinotherium.[3] p. 23. Bull : Soc. Geolog. 1837–8 Tom. IX. M. D'Urville on the Distrib. of Ferns in South Sea[4] (Indio Polynes : vegetation far East) Ann : des Sciences Semplémt. 1825.

Get Henslow[5] to read over the pages from about 8 to 20 of Zoologie of Coquille's Voyage to see if Lesson's remarks[6] on the Flora can be trusted. |

17–18 *excised.*

19 Coquille Voyage p. 25. Mais il n'y a pas jusqu'aux iles Macquarie et Campbell (52° S) qui n'aient également leurs espèces ; et certainement on eût été bien éloigné, il y a peu d'années, d'admettre que ces oiseaux eussent leurs représentants dans de si hautes latitudes ".[7] — ? translate ?

All Australian forms have representative (& instances given) in East Ind. Arch. — Birds of New Zealand absolutely different. — *Philedon cincinnatus* not found in
20 Australia only New Zealand — Norfolk Is[d] & New Caledonia | peculiar species of cassicans (? cassicans Australian form ?) p. 27. Many fish of Taiti found at Isle of France :[8] instance of wide range, when means of wide range says same remark with regard to shells. — But he says shells towards extremities of the continents peculiar to the different points. — Work this out. L. Jenyns[9] about my fish New Zealand and New Holland fish very similar. —

N.B. Lesson method of generalizing without tables of references highly unphilosophical. |

21 Consult Voyage aux terres australes[10] Chap XXXIX tom IV p. 223, 2d edit.

Consult Latreille Géographie[11] des Insectes in 8° p. 181 who says insects Indian like Plants.

[1] William Ogilby. *L'Institut*, tome 6, Paris 1838, p. 67. Zoologie : Rongeurs australasiens. " L'autre animal décrit par M. Ogilby, quoique n'appartenant pas à un nouveau genre, est également intéressant en ce qu'il jette quelque lumière sur les lois de la distribution géographique des animaux. C'est une vraie Gerboise (*Dipus*) des plaines centrales de la Nouvelle-Hollande."

[2] Christian Gottfried Ehrenberg. *L'Institut*, tome 6, 1838, p. 62. Paléontologie : Infusoires. " M. Ehrenberg lit une note sur les masses que forment les infusoires siliceuses."

[3] Heinrich Georg Bronn. " Sur l'age géologique des terrains tertiaires du bassin de Mayence," *Bull. Soc. Géol. France*, tome 9, 1838, p. 23 :—" MM. Klipstein et Kaup ont rapporté les couches contenant leur *Dinotherium* au calcaire grossier des environs de Paris."

[4] J. D'Urville. " De la distribution des fougères sur la surface du globe terrestre." *Annales des Sciences naturelles*, tome 6, Paris 1825, p. 51.

[5] John Stevens Henslow.

[6] René-Primevère Lesson, et Prosper Garnot. *Voyage autour du Monde exécuté sur la Corvette La Coquille. Zoologie.* Paris 1826, tome 1, pp. 12–19 are concerned with the floras of Oceania.

[7] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 25.

[8] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 27 :—" nous avons retrouvé à l'Isle de France un grand nombre des poissons de Taïti."

[9] Leonard Jenyns, afterwards Blomefield, author of the Section on Fish in *Zoology of H.M.S. Beagle* London 1842.

[10] François Péron. *Voyage de découvertes aux terres australes*, seconde édition revue corrigée et augmentée par M. Louis de Freycinet, tome 4, Paris 1824, p. 223 :—" Une observation très remarquable tend à confirmer l'origine que j'attribue ici aux incrustations de la Nouvelle-Hollande ; c'est que de l'immense étendue de côtes dont je viens de parler, le seul point sur lequel nous n'ayons pu voir aucune de ces incrustations, le port du Roi-George, se distingue aussi de tous les autres par la nature presque exclusivement quartzeuse de ses rivages."

[11] Pierre-André Latreille. *Mémoires sur divers sujets de l'histoire naturelle des insectes, de géographie ancienne et de chronologie*, Paris 1819, tome 4, p. 180 :—" Quoique l'entomologie de la Nouvelle-Hollande forme un type spécial, elle se compose néanmoins, en grand partie, d'espèces analogues à celles des Moluques et du sud-est des Indes."

It would be very important to show wide range of fish & shells in tropical seas it would demonstrate: not distance, makes species but barrier. It would make strong contrast with southern regions.—It would now represent what actually has is taking place with quadrupeds.

p. 118 wild pigs of Falklands generally " red of bricks " hair.[1] Very stiff.

p. 120 Coati roux common near Conception.[2] Some tatous !!!

p. 120 Most of the dogs of Payta belong to the hairless kind said to come originally from Africa.[3] |

22 p. 122 Mus decumanus at Caroline Is[ds] & a Roussette.[4]

p. 136 Isle of France. — the Tennecs [tenrecs] from Madagascar.

Monkey from Java.[5] —

Hairs [hares] & deer. — Procured two makis alive from there. —

Mem. Waterhouse knows of some species which escaped there. —

p. 139. Vespertilio bonariensis (from Buenos Ayres) holds same relation with equator that Vesp. lasiurus does in North Hemisphere.[6] — |

23–28 *excised.*

29 Rabbits introduced in 64 of very many colours, like the cattle which I say " are as variously coloured as a herd in England." — Black & grey varieties of rabbits thus handed down for nearly 70 years. Galapagos mouse not the same section with house mice. It is wonderful how it could have been transported? What section does the New Zealand Rat belong to. There is this great advantage in studying geograph. range of quadrupeds; that either created in each point, or migrated from those quarters where we know quadrupeds have existed for ages. — |

30 The most hypoth: part of my theory, that two varieties of many ages standing, will not readily breed together. The argument must thus be taken, as in wild state (where instinct not interfered with, or generative organs affected as with plants) no animals *very* different will breed together, so when two great (which can be shown probable) varieties may be made in wild state, there will be presumption that they would not breed together. — We see even in domesticated varieties a tendency to go back to oldest race, which evidently is tendency to same end as the law of hybridity, namely the |

[1] René-Primevère Lesson, et Prosper Garnot. *Voyage autour du Monde . . . Zoologie*, Paris 1826, tome 1, p. 118 :—" Les cochons se sont également propagés sur les iles Malouines, et principalement sur un ilot, qui est à l'entrée de la baie Française. Leur nourriture n'est ni succulente, ni même abondante: aussi leur chair maigre, quoique possédant un fumet agréable, n'a aucun rapport avec celle de nos cochons domestiques, et encore moins avec celle des sangliers. Leur poils d'une rudesse extrême sont généralement d'une couleur rouge de brique . . . "

[2] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 120 :—" Nous ne vîmes guère que le coati roux, qu'on dit être commun aux alentours de Penco, quelques tatous et une sorte de chat . . . "

[3] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 120 :—" Nous observâmes que la plupart des chiens de Payta appartenaient à la race des chiens sans poil (*Canis aegyptius*), le chien turc de Buffon, qui est originaire d'Afrique, suivant les auteurs."

[4] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 122 :—" Notre séjour sur l'île d'Oualan nous a permis d'y remarquer que deux espèces qui y soient vraiment indigènes. L'une est la roussette Kéraudren. . . . Le surmulot commun (*Mus decumanus, Mamm. Desm.*, 773) "

[5] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 136 :—"les tenrecs. Ces derniers, venus de Madagascar, . . . tandisque le singe (*Macacus sinicus*, Des. 32), originaire de Java, occupe les sommets escarpés de la montagne du Pouce."

[6] René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 139:—" Ces vespertilions vivent à une égale distance de l'équateur, dans les zones tempérées des deux hémisphères du continent américain."

31–32 *excised.*

33 animals unite, all the change that has been accumulated cannot be transmitted; hence the tendency to revert to parent forms, & greater fertility of hybrid & parent stock, than between two hybrids. — As we see external influences first affect external [for]m, so will the internal parts be of longest [?]nt & therefore most permanent. Owe[n re]markable laws of Brains & manner of generation & primary divisions of insects.[1]

2. Relation of external conditions, & of succession: the latter is most intimately connected with important structure, which are less obviously affected by external

34 circumstances. These therefore will be chiefly hereditary. — | If varieties produced by slow causes, without picking become more & more impressed in blood with time, then generation will only produce an offspring capable of producing such as itself. — Therefore two different varieties will produce hybrids but not varieties which are not deeply impressed on blood, will cross & produce fertile offspring. In first case it will either produce no offspring or such as not capable of producing again. |

35 The varieties of Cardoon are cases like those of Primrose & Cowslip run wild.

The two species of Clenonga case of replacing species. Dr Smith[2] will give me some capital information.

? Carnivora of New and Old wor[l]d do not form two sections, is this not connected with wide range of animals. Follow this out where species of same *genera* in

36 [...?...] word have not species generally wide range? Mice. — | Waterhouse's remarkable fact[3] of no forms peculiar to (to special districts ????) land north of 30°, may be connected with Mr Blyth's statement[4] of birds of Europe & America which are of different forms being migratory, also with Temmincks fact[5] of forms being within Tropics. — European birds at Japan connected with European forms[6] on Himalaya ?? — This is very remarkable when we consider number of quadrupeds in Eocene period. Have the Edentata & Marsupials forms been chiefly preserved, where shut up by themselves without other animals? But they were not shut up!! |

37 Extreme southern points of S. Hemisphere fully characterized of each continent. Try amongst European quadrupeds if Africa destroyed would not then some forms

[1] Richard Owen. The reference appears to be to Owen's Lectures. In the *Syllabus of an elementary course of lectures on comparative anatomy by Richard Owen* to be delivered at St. Bartholomew's Hospital during April and May 1835, in the analysis of Lectures IV and V, on page 5, appear the words :—" Changes effected in the nervous and other systems during the metamorphoses of insects."

[2] Andrew Smith, whom Darwin met in South Africa.

[3] George Robert Waterhouse. *The Zoology of the Voyage of H.M.S. Beagle*, Part II. Mammalia by George Robert Waterhouse. London 1839, p. 19 :—, *Felis pajeros* :—" it extends northwards as far as latitude 30°." p. 88 :—" *Lagostomus trichodactylus* is not found north of 30°." Darwin's obscure note would appear to mean " no forms peculiar to South America."

[4] Edward Blyth. The reference is presumably to " Further remarks on the affinities of the feathered race," *Mag. Nat. Hist Lond.* vol. 9, 1836, p. 509 :—" Many years have now elapsed since the genius of Buffon suggested the capital proposition that there is no absolute specific identity between any organism of the Eastern and Western continents, with the exception of those which inhabit very far to the north."

[5] Coenraad Jacob Temminck. Perhaps *Histoire naturelle générale des pigeons et des Gallinacés*, Paris 1813, tome 1, p. 6 :—" Il paroit que les Pigeons et les Gallinacés habitent de préférence les parages de la zone torride."

[6] This question is prompted by Edward Blyth : " Further remarks on the Affinities of the feathered Race ", *Mag. Nat. Hist. Lond.* 9, 1836, p. 510 :—" we have every grade of diversity, from the obviously distinct Japanese peafowl (*Pavo muticus*), to the mealy linnet, which, apparently, differs in no respect from that of Europe."

be peculiar to it, so on & so on. — Whatever destroyed great Pachyderms in S. America destroyed great Edentata or American form. — Is the Australian Dipus an American form? The climates having grown more extreme both in N. & S. America, is only common cause I can conceive of destruction of great animals in Europe & America. |

38 Some portion of the world (Africa) being left more equable (yet America pre-eminently equable) might have allowed fresh species to have been formed & spread to other Africa & East India Arch. — But where these great animals had not spread then such tribes as Marsupial & Edentates increased most. Certainly Africa approaches nearest to what is supposed to have been condition of former whole world. America must have been string of islands. — |

39–44 *excised.*

45 The systematic naturalists get clear indication of circumstances in Geography to help in distinguishing empirically what is species. — The collector is directed to study localities of isl^{ds}. — Immense importance of local faunas foundation of all our knowledge especially great continents.

Give specimen of arrangement.

Rhinoceros

3 species — Cape Town good species
Indian species so distinct that all analogy [?]

from each other
I do not know how different. { Sumatra / Java } —ditto from India

Some doubt from want of knowledge of times analogy from three first will give one *almost* certain guide ∴ time required to separate isl^{d} very long. Increase of knowledge would probably tell more *certainly*. Get closer species. Foxes good case on account of varieties in N. America. Mice of America. |

46 America & Indian deer.—Africa not.—Africa camels?? Africa *Bears*?? *Plantigrade carnivora*?? — Compare rodents of two countries & monkeys. Fact of Elephant same species in Borneo Sumatra India Ceylon — perhaps show great persistency of character. Hence Elephas primigenius over so wide a range & Mastodon angustidens. — Ogleby[1] has facts to show that Australian dog introduced by savages into Australia. — What are they? Colonel Montagu[2] probably contains some facts about close species of Birds. |

47–50 *excised.*

[1] William Ogilby. "Notice of certain Australian Quadrupeds, belonging to the Order Rodentia", read December, 1837; *Trans. Linn. Soc. Lond.*, vol. 18, 1841, 121. On page 121 :—"...I think, that there are strong grounds for believing that the *Dingo*, or native dog, ... is not an aboriginal inhabitant of the continent, but a subsequent importation, in all probability contemporary with the primitive settlement of the natives...."

[2] George Montagu. "Observations on some species of British Quadrupeds, Birds, and Fishes. *Trans. Linn. Soc. Lond.*, vol. 7, 1804, p. 274. On page 282 :—"were it not for the strong chestnut colour the Kentish Plover is said to possess on the crown of the head, as described by Lewin, and since by Dr Latham in the Second Synopsis to the General Synopsis, we should not have hesitated in pronouncing these three birds to be only one species." Page 287 :—"It is indeed remarkable that a bird bearing such strong marks as the Black-headed Gull, in all the changes, from the nestling to the adult plumage, should have ever been multiplied into so many species [i.e. "brown gull", and "brown turn".] ... of the several, remarkable changes incident to the black-headed Gull ... one of those mutations is the identical bird in question, the Brown Gull."

51 Instinct goes before structure (habits of ducklings & chickens young water ouzels) hence aversion to generation, before great difficulty in propagation. —

Feathers on Apteryx because we may suppose longest part of structure. — Shape of wings have altered many times, but all have had feathers, — if wing totally obliterated. — This may account for permanence in many trifling marks, — such as the bands on pidgeons back. — According to this description of class is description |
52 of ancestor of all birds, & so for birds, we thus obtain an abstract idea of a bird, an animal with skeleton of such general forms. —

The hybridity of ferns bears on my doctrine of cross-generation.

The infertility of crosse & cross is method of nature to prevent the picking of
53 monstrosities as man does. — One is tempted to exclaim | that nature conscious of the principle of incessant change in her offspring has invented all kinds of plan to insure sterility, but isolate your species her plans are frustrated or rather a new principle is brought to bear.

If man created as now languages would surely have been homogeneous. —

There must be some sophism in Lyell's statement[1] that some species vary more than what makes species in other animals. — |
54 Forster on South Sea[2] will probably contain description of domesticated animals in those regions.

Species so far are not natural that they are *either* A.B.C.D.E *or* A.C.D.E.H. Very striking to see M. Bibron[3] looking over reptiles he often had difficulty in distinguishing which were species (theory admirably) yet a glance would tell from which country. — I often disputed for a moment. — Galapagos, S. American genera. —
55 The circumstances of having | two sexes is the check to distribution of birds & animals.

Mrs. Strickland & Hamilton[4] found tertiary formation amongst Greecian isles ?see if type continued? See to Babbage[5] & Virlet.[6] — Whewell[7] thinks (p. 642) anniversary speech Feb. 1838 thinks gradation between man & animals small point in tracing history of man. — granted. — but if all other animals have been so formed,
56 then man may be a miracle, but induction leads to other view. — | Till we know uses of organs clearly, we cannot guess causes of change. — hump on back of cow!! &c. &c.

[1] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 25 :—" we have only to suppose that what is true of size, may also hold in regard to colour and many other attributes, and it will at once follow that the degree of possible discordance between varieties of the same species, may in certain cases exceed the utmost disparity which can even arise between two individuals of many distinct species."

[2] John Reinhold Forster. *Observations made during a Voyage round the World, on Physical Geography* &c. London 1778, refers only to hog, dog, and cock among the domestic animals.

[3] Gabriel Bibron, author of " Reptiles " ; *Voyage autour du Monde exécuté pendant* 1836, *et* 1837 *sur la Bonite* ; *Zoologie*, tome 1, Paris 1841.

[4] Hugh E. Strickland, & William John Hamilton. " An account of a Tertiary deposit near Lixouri, in the island of Cephalonia ", *Proc. Geol. Soc. Lond.*, vol. 2, 1834, p. 545.

[5] Charles Babbage. " Observations on the temple of Serapis at Pozzuoli, near Naples ; with remarks on certain causes which may produce Geological Cycles of great Extent ", *Proc. Geol. Soc. Lond.*, vol. 2, 1833, p. 72.

[6] Pierre-Théodore Virlet d'Aoust. *Expédition scientifique de Morée*, Paris 1833–5.

[7] William Whewell. " Address to the Geological Society, delivered at the Anniversary, on the 16th of February 1838, by the Rev. William Whewell, President of the Society. " *Proc. Geol. Soc. Lond.*, vol. 2, 1838, p. 642. On page 642 :—" The gradation in form between man and other animals, a gradation which we all recognise, and which, therefore, need not startle us because it is presented under a new aspect, is but a slight and, as appears to me, unimportant feature, in looking at the great subject of man's origin."

D'Orbigny (p. 108) says[1] having observed B. tricolor in Patagonia then in Chile & lastly 12.000 feet above sea in Bolivia, he examined all species & found " beaucoup des mêmes oiseaux que nous avions déja observés en Patagonie ou au moins des
57 espèces très-analogues, quand ce n'étaient | pas tout à fait les mêmes ". This good case of replacement under peculiar conditions — of nearly same kind country distant.

The circumstances of ground woodpeckers, — birds that cannot fly &c. &c. seem clearly to indicate those very changes which at first it might be doubted were possible, — it has been asked how did the otter live before it had its web-feet. All nature answers to the possibility. —

My views will explain no mammalia in secondary epochs & developement of lizards. |
58 As we have birds impressions in Red Sandstone great lizards in ditto. — Coniferous wood in Coal Measure. — highest fish in old Red Sandstone. — Nautili in [*blank*] it is useless to speculate not only about beginning of animal life generally, but even about great division. Our question is not how there come to be fishes & quadrupeds
59 but how there come to be many genera of fish &c. &c. at present day. — | It is *assumption* to say generation produces young ones capable of producing young ones like itself, but?whether great assumption? not solely producing like itself, not applicable to monster.—Are monstrosity hereditary??? Does not atavism relate to this law? —

Local varieties formed with extreme slowness even when isolation from general circumstances effecting the area equably. — |

60 Animals having wide range, by preventing adaptation owing to crossing with unseasoned people would cause destruction. — Simile man living in hot countries, if continually crossed with people from cold, children would not become adapted to climate. —

Descent, or true relationship, tends to keep the species to one form (but is modified). The relationship of analogy is a divellent power & tends to make forms remote antagonist powers. — Every animal in cold country has some analogy in hot gaudy
61 colours so all changes may be considered in this light. — | Hence relation of analogy may chiefly be looked for in the aberrant groups. — It is having walking fly catcher, woodpecker &c &c which causes the confusion in this system of nature. — Whether species may not be made by a little more vigour being given to the chance offspring who have any slight peculiarity of structure. hence seals take victorious seals, hence deer victorious deer, hence males armed & pugnacious all order ; cocks all war-like ; this wars against the resemblances relationship, the dissemblances analogy, in any class those points which are different from each other, & resemble some other class, analogy. See Abercrombie[2] p. 172 for definition of analogy.

Zoolog. Journal.[3] Parrots in Macquarie is[ld] vol. III p. 430 alluded to by Capt. King.

[1] Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale* . . . 1826–33, tome 4, Paris 1835, p. 108 ; observations on *Buteo tricolor*.

[2] John Abercrombie. *Inquiries concerning the Intellectual Powers and the Investigation of Truth*, Edinburgh 1830, p. 171 :—" 2. Relations of resemblance and analogy . . . When there is a close agreement between two events or classes of events, it constitutes resemblance ; where there are points of difference, it is analogy. In the latter case, we then trace the degrees of analogy, depending upon the number of points in which the resemblance holds, and the number of points in which there is a difference."

[3] Phillip Parker King. " On the Animals of the Straits of Magellan ", *Zool. Journ.* vol. 3, London 1828, p. 430 :—" Parrots as you are well aware are brought from Macquarrie Island . . . "

62 Ditto p. 434 Table of birds from Cuba. Vigors,[1] nothing of much interest. | All the discussion about affinity & how one order first becomes developed & then another — (according as parent types are present) must follow after there is proof of the non creation of animals. — Then argument may be, — subterranean lakes, hot spring &c &c inhabited therefore mud wood [would] be inhabited, then how is this
63 effected by — for instance, fish being excessively abundant | & tempting the Jaguar to use its feet much in swimming, & every developement giving greater vigour to the parent tending so produce effect on offspring — but *whole* race of that species must take to that particular habitat. — All structures either direct effect of habit, or hereditary & combined effect of habit, — perhaps in process of change. — Are any men born with any peculiarity, or any race of plants. — Lamarck's willing absurd,[2] ∴ not applicable to plants. |

64 Epidemics of South Sea wonderful case of extermination of species. — Epidemic amonst trees. Plane trees all died certain year. Extreme difficulty of *tracing* change of species to species although we see it effected tempts one to bring one back to distinct creations. — It is only be [by] recollecting that the ground woodpecker &c fresh water animals of great Lakes are American form that one is brought to admit the
65 possibility | (any great change in species is reduced by atavism). Even a deformity may be looked at as the best attempt of nature under certain very unfavoured conditions, — as an adaptation, but adaptation during earliest existence ; if whole life then real adaptation. The case of hereditary disease is on the same principle that cut a sheeps tail off plenty of times & you will have no tail (example probably not true) — or again healthy parents have healthy children. The other case is change during life of parent & therefore being always necessary may be called adaptation. |

66 With respect to my theory of generation, fact of armless parent not having armless child, shows that there is reference to more than offspring (like atavism) & shows my view of generation right? — If puppy born with thick coat monstrosity, if brought into cold country & then acquired then adaptation. — |

67 No Common Vultures in Australia[3]!! Wilsons ornithology. vol. III p. 226. Wilsons Ornithology, D'Orbigny,[4] Spix,[5] &c might compare birds of N. America & South, — any how temperate regions, — crows in N. America. Study Bonapartes[6] list.

In the Zoological Journal[7] I read a curious account to show that *very* many birds of different kinds have been known to assist in feeding young cuckoos ; as if there was storge [strong urge], which could not be resisted, when hearing cry of hunger of

[1] Nicholas Aylward Vigors. " Sketches in Ornithology etc.," *Zool. Journ.*, vol. 3, London 1828, p. 434 : —" the following 45 species occur among the birds from Cuba . . . "

[2] Jean-Baptiste de Lamarck. See Introduction to First Notebook, p. 32.

[3] Alexander Wilson. *American Ornithology*, vol. 3, London 1832, p. 226 :—" The Vultures are comparatively a limited race, and exist in every quarter of the world, New Holland excepted . . . "

[4] Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale* . . . tome 4, 3e partie, Paris 1839.

[5] Johann Baptiste von Spix. *Travels in Brazil in* 1817–20, London 1824.

[6] Charles-Lucien Bonaparte. *A Geographical and Comparative List of the Birds o Europe and North America*, London 1838.

[7] John Blackwell. " Facts relating to the natural history of the Cuckoo ", *Zoological Journal*, vol. 4, 1829, p. 294 :—" In the Gentleman's Magazine for April 1806 two instances are recorded of young cuckoo having been occasionally fed by large numbers of birds of the same species as their foster parents . . . "

68 little bird. In same way Wilson[1] | (p. 5) describes many kinds of birds uniting together in pursuit of Blue Jay, when birds hears cry of distress of other parents. — Shows community of language.

Desert country is as effectual as a cold one in checking beautiful colours of species. — Mem. St. Jago; solitary Halcyon bird of passage. — M. coronata of Latham, wrong. Mr. Yarrell says that some birds or animals are placed in white rooms to give tinge to
69 offspring. Darkness effect on human offspring. — | White snow, — the fine green of vegetation, — ? account for colour of bird in district which they frequent!!? Wilsons' American ornithology[2] a mine of valuable facts, regarding habits range & all kinds of information, instinct. Swainson's remarks in Fauna Borealis[3] must be studied. There is capital talk of extent of all species. Accumulate instances of one family sending out structures into many genera, — like Synallaxis or Marsupial animals
70 of N. America. | Hence it is universally allowed that the discrimination of species is empirical. Show this by instances.

Once grant my theory & the examination of species from distant countries may give thread to conduct to laws of change of organization! The little turtle without its parent running to the water is a good instance of innate instinct, better than child sucking or even duckling & fowls.

When talking of races of man, — black men, black bull finches from linseed, — notably effects of climate on some antecedent race perhaps not one now existing. |
71–72 *excised.*

73 Study the wars of organic being. — The fact of guavas having overun Tahiti, thistle Pampas show how nicely things adapted. — The abberrant varieties will be formed in any kingdom of nature where scheme not filled up (most false to say no passages; nature is full of them. — Wading birds partially webbed &c &c) — & in round of chances every family will have some aberrant groups, — but as for number five in each group absurd. — The mere fact of division of lesser & more power (2.
74 typical 3. subtypical) | where power arbitrary, leaves door open for Quinarians to deceive himself. — Give the case of Apterix split, depress & elevate & enlarge New Zealand, a division of nature of Apterix, many genera & species.

The believing that monkey would breed (if mankind destroyed) some intellectual being though not MAN, — is as difficult to understand as Lyells doctrine of slow movements[4] &c &c. |

75 This multiplication of little means & bringing the mind to grapple with great effect produced is a most laborious & painful effort of the mind (although this may appear an absurd saying) & will never be conquered by anyone (if has any kind of prejudices) who just takes up & lays down the subject without long meditation. — His best chance is to have [pondered] profoundly over the enormous difficulty of

[1] Alexander Wilson. *American Ornithology*, London 1832, vol. 1, p. 5 :—" The cries of the distressed parent soon bring together a number of interested spectators, (for birds in such circumstances seem truly to sympathize with each other) and he [blue jay] is sometimes attacked with such spirit as to be under the necessity of making a speedy retreat."

[2] Alexander Wilson. *Ibid.*

[3] William Swainson. *Fauna Boreali-Americana ; or the Zoology of the Northern parts of British America.* Part II, the Birds, London 1831.

[4] Charles Lyell. The reference is to the production of great effects as a result of slow action over great periods of time, which is the basis of the *Principles of Geology*.

reproduction of species & certainly of destruction ; then he will choose & firmly believe in his new faith of the lesser of the difficulties. |

76 Once grant that species and genus may pass into each other, — grant that one instinct to be acquired (if the medullary point in ovum has such organization as to force in one man the developement of a brain capable of producing more glowing imagining or more profound reasoning than other, if this be granted!!) & whole fabric totters & falls. — Look abroad, study gradation, study unity of type, study
77 geographical distribution, | study relation of fossil with recent. The fabric falls! But man — wonderful man " divino ore versum coelum attentior " is an exception. — He is mammalian, — his origin has not been indefinite. — he is not a deity, his end under present form will come, (or how dreadfully we are deceived) then he is no exception. — He possesses some of the same general instincts all & feelings as animals. They on other hand can reason — but man has reasoning powers in excess, instead
78 of | definite instincts — this is a replacement in mental machinery so analogous to what we see in bodily, that it does not stagger me. — What circumstances may have been necessary to have made man! Seclusion want &c & perhaps a train of animals of hundred generations of species to produce contingents proper. — Present monkeys
79 might not, — but probably would, — the world | now being fit, for such an animal — man, (rude uncivilized man) might not have lived when certain other animals were alive, which have perished. Let man visit Ourang-outang in domestication, hear expressive whine, see its intelligence when spoken [to], as if it understood every word said — see its affection to those it knows, — see its passion & rage, sulkiness & very extreme of despair ; let him look at savage, roasting his parent, naked, artless, not improving, yet improvable and then let him dare to boast of his proud preeminence. — Not
80 understanding language of Fuegian puts on par with monkeys. | Gould seems to think that many species when close come from different localities as my Funaire — some genus of yellow and brown breasted bird in Australia &c &c — but of course they might be blended, if archipelago turned into continent &c &c.

There is beautiful gradation of forms in Australia leading on one side into shrikes & at the other into crows. Yet all forming, according to Gould,[1] good genus. |
81 Gould seems to doubt how far structure & habits go together. This must be profoundly considered. — Structure may be obliterating, whilst habits are changing, or structure may be obtaining, whilst habits slightly preceed them — From this view habits must form most important element in considering to which tribes — structure
82 without corresponding habits clearly showing true affinity, for instance | tail of ground woodpecker, — but tail of some ducks aberrant from habit. —

Gould[2] I see quite recognizes habits in making out classification of birds.

Birds vary much (more than shells) owing to variety of station inhabited by them.
83 Timor. Australian forms amongst birds | Java, not so much. — Peculiarities of structure as six-fingered people are sometimes hereditary — yet these not adaptations — they are counteracted by nature by crossing with other varieties, but accidental[3] changes after

[1] John Gould. " Characters of two new species of birds constituting a new genus, *Aplonis*." *Proc. Zool. Soc. Lond.*, Part IV, 1836, p. 73 :—" He stated them to approximate, in his opinion, in nearly an equel degree to the genera *Lanius*, *Turdus*, and *Lamprotornis*."

[2] John Gould. The reference is to Gould's treatment of species in *The Birds of Europe*, London 1837.

[3] This word crossed out in MS.

birth do not effect progeny. Many dogs in England must have been lopped off & sheeps tails cut yet there is no record of any effect. — New Hollanders have gone on boring their noses &c &c. This congenital changes show that grandson is determined,
84 when child is, — | shows that generation implies more than mere child, but that child should produce like children. Lyell has story from Beck[1] about six fingered children hereditary.

With respect to question which is adaptation, — examine ptarmigan, hare becoming white in winter of Arctic countries few will say it is direct effect, according to
85 Physical laws, as sulphuric acid disorganizes | wood, but adaptation. — Albino however is monster, yet albino may so far be considered as adaptation, as best attempt of nature colouring matter being absent. — Again dwarf plant on alpine district & dwarf plant from seed, one adaptation other monsters. —

The only way of judging whether structure is owing to habits or hereditary is to see
86 whether a large family has it, & one member of that | family having it with very different habits. — Thus bill & nostril of Puffinuria I think we may clearly attribute to hereditary origin & not adaptation to its habits. — Few will dispute that it is possible to have structure without habits — after seeing beetle with wings beneath
87 soldered wing-cases — yet these wings may be of some use. — Nature | is never extravagant though clearly not of the use to which wings are generally applied. — Therefore argument not destroyed even if their shrivelled wings could be shown to be of some use. If we only had Puffinuria Garnottii & no other species — as we have only Ornithorhync[h]us, then we should never know how much structure was connected with habits, & how much hereditary. The circumstance of aberrant groups being small it is truism, for if not so not aberrant. — |

88 Taenioptera rufiventris is instance of bird belonging to family with peculiar coloured plumage, where colours have changed in accordance to habits, — one is tempted to suppose from beholding the ground. — Why do beetles & birds become dull coloured in sterile countries. —

Gould insist much upon knowing to what type a bird belongs. — I conceive without knowing from which country many birds come it would be impossible to classify them. — I would |

89–98 *excised.*

99 element geographical distribution is. — ? Pelagic forms — similar birds?? —

We must always bear in mind proofs of most equable climate both in S. & N. Hemisphere just anterior to present. ? cause of destruction of great animals?

Show independency of shells to external features of *land* by seeing how many species common to Patagonia & Tierra del Fuego & forest. insert Parrots in Macquarrie Isd.[2] Coast very good. Study D'Orbigny[3], & range in West Guyaquil & Peru. |

[1] Charles Lyell. The 5th edition of the *Principles of Geology* has three references to Dr J. Beck of Copenhagen, quoted for geological observations. The present reference appears to be to a personal communication to Lyell.

[2] Phillip Parker King. " On the Animals of the Straits of Magellan ", *Zoological Journal*, vol. 3, London 1828, p. 430 :—" Parrots as you are well aware are brought from the Macquarrie Island . . . "

[3] Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale*, Paris 1835.

100 Henslow[1] in talking of so many families on Keeling seemed to consider it owing to one of each being fitter for transport. ? may it not be explained by mere chance? — or [is] it like each great class of animals having its aquatic aerial &c type? — This of consequence because applicable to N. Hemisphere.

N.B. Examine Abrolhos Flora with this view. Tristan D'acunha. St. Helena &c &c Juan Fernandez. |

101–102 *excised.*

103 After reading " Carus on the Kingdoms of Nature, their life & affinity ",[2] in Scientific Memoirs I can see that perfection may be talked of with respect to life generally. — When unity constantly develops multiplicity (his definition " constant manifestation of unity through multiplicity ") this unity, — this distinctness of laws from rest of universe (which Carus considers big animal) become more developed in higher animals than in vegetables.

p. 243 radiate animals plants turned inside out,[3] have portion of organ of generation!!! Mem. Agasziz (1 No. Annals of Nat. Hist.) *spiral* structure in Echinodermata.[4] |

104 Agassiz says Infusoria are insecta[5] —

G. R. Treviranus Biologie[6] referred to as compilation of action of organic nature on inorganic.

It is very remarkable as shown by Carus[7] how intermediate plants are between animal life & " *inorganic* life ". animals only live on matter already organized. —

This paper might be worth consulting if any metaphysical speculations are entered on upon life. namely Carus. |

105–118 *excised.*

119 alone, but on all the general arguments —

Lamarck was the Hutton of Geology, he had few clear facts, but so bold & many such profound judgment that he foreseeing consequence was endowed with what may be called the prophetic spirit in science. The highest endowment of lofty genius.[8]

[1] John Stevens Henslow. Personal communication.

[2] Karl Gustav Carus. "On the Kingdoms of Nature, their Life and Affinities", *Scientific Memoirs selected from the Transactions of foreign Academies of Science and Learned Societies and from foreign Journals*, edited by Richard Taylor, vol. 1, 1837, p. 223.

[3] Karl Gustav Carus. *Ibid.*, vol. 1, 1837, p. 243 :—" We may now see why in the Medusa, the Sea-Star, the Echinus, and other inferior kinds of animals, the aperture of the mouth is turned downwards and the alimentary duct upwards . . . "

[4] Louis Agassiz. " Prodromus of a Monograph of the Radiata and Echinodermata ", *Ann. Nat. Hist.* vol. 1, 1838, p. 30.

[5] Louis Agassiz. Reference untraced.

[6] Gottfried Reinhold Treviranus. *Biologie oder Philosophie der lebenden Natur für Naturforscher und Aerzte*, Göttingen, 1802–1822.

[7] Karl Gustav Carus. " On the Kingdoms of Nature . . . " *Scientific Memoirs* edited by Richard Taylor, vol. 1, 1837, p. 234 :—" The animal stands in the same relation to the vegetable kingdom as organized bodies in general do to the unorganized. . . . "

[8] This remarkable sentence lacks a word, for as it stands it makes no sense since no man but Hutton was the " Hutton of Geology ". It seems that the sentence should read :—Lamarck was the *French* Hutton of Geology, referring to Lamarck's *Hydrogéologie, ou recherches sur l'influence générale des eaux sur la surface du globe terrestre, sur les causes de l'existence du bassin des mers, de son déplacement, de son transport successif sur les différents points de ce globe, enfin sur les changemens que les corps organisés vivant exercent sur la nature et l'état de cette surface.* Paris 1802. In this work Lamarck put forward the view that Nature had unlimited time at her disposal.

Using geographical distribution of animals, I use (new step in induction) as keystone of ancient geography species tell of Physical relations in time, form & distribution tells of horizontal barriers — |

120 Mr. Yarrel — says[1] my view of varieties is exactly what I state, — or picking varieties unnatural circumstance.

L[d] Orfords had breed of greyhounds fleetest in England lost courage at end of chase would not run up hill.[2] (Bull-dogs are used because they have no scent. J. M. Wynne.[3]) He took thorough bred bull-dog & crossed & recrossed till there was a dash of blood with whole form of greyhound, — picking out finest of each litter & crossing them with finest greyhounds. —

Sir J. Sebright[4] first got[5] point on hackles on Bantams by crossing with common *Polish cock* is that not old variety & then recrossing offspring till size diminished, but feathers continued by picking chicken of each brood. — These bantam feathers |

121 at last got dusky, then took white Chinese Bantam crossed & got some yellow & others yellower & white varieties by picking the yellow ones & crossing with dark bantam produced old variety. —

The pidgeons which have such different skulls, but same marks on wings are Blue Pouter & small Bald Heads Mr. Yarrell will mention in his work.[6]

I am sorry to find Mr. Yarrell's evidence about old varieties is reduced to scarcely anything, — almost all imagination — He says he recollects all half Bred cattle of L[d] Darnleys were most like parent Brahmin bulls — Mr. Y. is inclined to think that the male communicates the *external* resemblances [more] than the female. |

122 The expression hybrid & fertile Hybrids may be used to varieties as well as species.

As formation of species gradual so may we suppose that something intermediate, between no offspring & ordinary offspring. — This gradation is infertile offspring without organs of generation?! By profound study of local variation laws of change whether beak (as it appears to me) colour of plumage & laws which might probably be reduced. |

123 What the Frenchman did for *species* between England and France I will do with *forms*. —

Mention persecution of early Astronomers, — then add chief good of individual scientific men is to push their science a few years in advance only of their age, (differently from literary men,) must remember that if they *believe* & do not openly avow their belief they do as much to retard as those whose opinion they believe

124 have endeavoured to advance cause of truth. | It is of the utmost importance to show that habits sometimes go before structure. — the only argument can be a bird practising imperfectly some habit, which the whole rest of other family practise with a peculiar structure, thus Tyrannus sulphureus if compelled solely to fish, structure would alter. —

It is a difficulty how a different number of vertebrae are produced when (& in all

[1] William Yarrell.
[2] *cf. Variation of Animals and Plants under Domestication*, vol. 1, London 1868, p. 68.
[3] Wynne. Unidentified.
[4] Sir John Sebright. *cf. Variation of Animals and Plants under Domestication*. vol. 2, London 1868, p. 197.
[5] A small drawing at this place in MS.
[6] William Yarrell. *A History of British Birds*, London 1837–43.

such structures) there cannot be gradation. See what Eytons young pigs[1] — if vertebra much lengthened or there may be tendency to divide which often enough |
125 repeated would cause an unequal number of vertebrae —

? When two very close species inhabit same country are not habits different. (Mem. Gould's willow wren)[2] but when close species inhabit different countries habits similar ?law? probable — ∴ if habits & structure similar would have blended together. Mem. Mr Herbert's[3] law, *habits* determining *fertility*. |

126 Scheme for abolishing specific names & giving subgenera true value — as in Opetiorhync[h]us fuliginosus (a) Falklands
(b) T. del Fuego differ from
(c) Chiloe
(d) Chile
rupestris — good species.

?O. modulator + O. patagonicus. till neutral ground ascertained call them varieties but two ostriches good species because interlock.

It is reverting to old plan but reason now assigned for doing so. There should be mark to every species only known by analogy genera of course distant analogy
127 from every country & class tells us that. | Analogy to be guide in islands species, — each describer giving his test namely differ as much as those (naming them) which are found together. —

If two species come over to this country without range or habits ascertained, put them as (a) (b) until data be given.—This will aid in preventing the chaos, — will point out what to observe, — will aid us in physiology. tell traveller what to observe, — if he knows he has done least part, — that he will not have brought home new species until he can show range & habits. —

Take instance of most disputed shells such as Cyrena. |

128 This is reform which probably will be slow but must take place. — Such a classification would answer every purpose & would present many ideas of causes of change. — The mark of analogy would be empirical because as soon as two species were placed in different subgenera, then it would be useless, but the formation of subgenera is empirical & is judged solely by comparison with other genera in other families. — it will however be much surer, when false species banished by this
129 test. — | Excepting where as Andrew Smith,[4] Richardson[5] & Vaillant,[6] & D'Orbigny[7] has travelled this will be most difficult.

Sub genera so far may be eliminated where every species of a section is confined to one continent & every species [of another section] to another. then those sections

[1] Thomas Campbell Eyton. "Notice of some osteological peculiarities in different skeletons of the Genus *Sus*," *Proc. Zool. Soc. Lond.*, vol. 5, 1837, p. 23.
[2] John Gould. *The Birds of Europe*, vol. 2, London 1837, pl. & p. 131. (unnumbered). Description of Willow-wren, Chiff-chaff, and Wood-wren, including the differences in their songs and habits.
[3] The Rev. The Hon. William Herbert.
[4] Andrew Smith. *Report of the Expedition for exploring central Africa from the Cape of Good Hope . . . 1834, under the superintendence of . . . A. Smith*, Cape Town, 1836.
[5] Sir John Richardson. *Fauna Boreali-Americana ; or the Zoology of the northern parts of British America*, London 1829–37.
[6] François Levaillant. *Voyage . . . dans l'intérieur de l'Afrique, par le Cap de Bonne Esperance dans les années* 1780–85, Paris 1790.
[7] Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale*, Paris 1835–47.

& subgenera are analogical, because we do not know whether nearest species of each might not breed.[1] — Genus must be a *true cleft* putting out of case the analogys. — If genus does not mean this it means nothing. — There should be some term used, when there is series. |

130 Could I not give Catalogue of Mammalia arranged according to my own methods.

Dasyurus being found fossil in Australia, & only one tree species (Mitchell's[2] authority) in Australia & several in Van Diemen's land is most important as showing former connection of two continents and death of form in one. The caves are at a

131 height of more than 1000 ft. & many hundred miles | from the sea, associated with teeth of seals and dugong, therefore immense age since breccia accumulated. — Surely ask Owen to see whether species same, excessive improbability. Mem. in Clift[3] list a rat said to have been found!! rodents old inhabitants most important!! like Dipus of present day??! Major Mitchell does not think that dog was found in Van Diemens land. —

V. I[st]. Number of Geographical Journal to discover whether dog found at Swan River. |

132 The change in England from Rhinoceros elephants &c in the most modern period, compared to Faunas of these countries, greater than Toxodon, Macrauchenia &c compared to America — the wonder is that the European forms were able to escape to some more fitting country. if Toxodon had been found in Africa the wonder [would] have been same for S. America & Europe. — the difficulty is how came it animals not preserved in Central S. America & yet in Africa & India??? — & Indian Isl[ds].[4] |

133 Sir J. Sebright pamphlet[5] most important showing effects of peculiarities being long in blood. Fully supported by Mr. Wilkinson[6], — milking hereditary, developement of important organ (see mark on pages), — crosses of diff : breeds succeed, yet seems to grant that difficult & other go back to either parent. — thinks difficulty in crossing race — bad effects of incestuous intercourse. — excellent observations of sickly offspring being cut off so that not propagated by nature. — Whole art of making varieties may be inferred from facts stated. — |

134 Shows instinct (Sir J. Sebright admirable essay) hereditary journey wild ducks. — lose as well as gain instincts. Wild & tame rabbit good instance — instincts of many kinds in dogs as clearly applicable to formation of instincts in wild animals many species in one genus external circumstances in both cases effect it. — Sir J. Sebright excellent authority because written on dog. Barking — applies it to national character. — |

[1] This paragraph up to here is marked by a query in the margin.

[2] Sir Thomas Livingstone Mitchell. *Three expeditions into the interior of eastern Australia, with descriptions of the recently explored region of Australia Felix, and of the present colony of New South Wales*, London 1838, vol. 2, p. 363 (Owen's identification of fossil specimens of *Dasyurus laniarius*.) The caves and their contents were first reported by Major T. L. Mitchell : " An account of the limestone caves at Wellington Valley, and of the situation, near one of them, where fossil bones have been found." *Proc. Geol. Soc. Lond.*, vol. 1, 1831, p. 321.

[3] William Clift. " On the succession of types of fossil mammals from Australian caves closely allied to living marsupials ". *Edinb. New Phil. Journ.*, vol. 10 1831, p. 394. The source where Darwin found this reference was no doubt Charles Lyell's *Principles of Geology*, vol. 3, London 1833, p. 144.

[4] The words " & Indian Isl[ds] " added in pencil.

[5] Sir John Sebright. *Observations upon the instinct of Animals*, London 1836.

[6] J. Wilkinson. " Remarks addressed to Sir J. Sebright ", London 1820.

135 N.B. If two species were excessively old they would not make hybrids, whereas two newer ones even if more different might do so, — is this true?? My views which would even lead to anticipate mules is very important for Lyell said to me the fact of existence of mules appeared to him most strange. — This even might be said — my theory thus explains a grand apparent anomaly in nature. —

Many animals not breeding at all in domestication throws great difficulty in way of ascertaining about hybrids, — & is very remarkable fact, show influence of mind. |

136 It is not difficult to see that it is less repugnant to nature to produce one offspring unlike itself, than to produce that capable of producing itself alike. — in one case it changes one, in other it changes thousands in futurity. — This is right way of viewing it. — Variety when long in blood gets stronger & stronger, so that though by great effort one unlike can be produced, yet to produce whole generation unlike would go against the tendency it tries to go back to grandfather, but if too unlike its own parent this impossible (Hence we might expect even if two mules bred or two certain

137 varieties, they would go back to grandfather which is | true) & infertility is consequence. —

The simple expression of such a naturalist " splitting up his species & genera very finely " show how arbitrary & optional operation it is, — show how finely the series is graduated. —

Dr Beck[1] doubt of local varieties should be remembered. Therefore do not consider it as proved that they are varieties (though that would be best).

Argue the case theoretically if animals did change excessively slowly whether[2]

138 geologists would not find fossils such as they are. — | My theory explains that *family* likeness, which as in absolute human family is undescribable yet holds *good*, so does it in real classification. The relation of all cock birds in Gallinaceous having tendency to [. . ?] or peculiar tails, strange.

?? Genus only natural from death or slow propagation of forms — just same way as all men not all equally related to each other. I cannot help thinking good analogy might be traced between relationship of all men now living & the classification of animals. — talking of men as related in the third & fourth degree. — |

139 A species must be compared to family entirely separated from any degree ; the tailor [tailer] in each branch would be analogous to each other &c &c. — v. p. 140.

I should think meaning of circular arrangement was only so far true as avoided linear arrangement the central twigs dying, affinities would be in broken circles — which in each group is quite fatal. — Relations of analogy being those last obtained less firmly fixed & therefore most subject to change, — may account for certain organs not being fixed in some genera which are most fixed in others. |

140 In analogy it is not the relation to bear to each other but to some external contingency. — Affinity is the sum of all the relations, analogy is the close relationship in some one. — Imagine the men to have greater powers of change yet, as external conditions over whole world similar & constitution of men originally similar, limits of change would be same. Yet each family might have its own character. — We

[1] Presumably Dr Henrich Henrichsen Beck of Copenhagen who is referred to three times in Lyell's *Principles of Geology*, 5th edition, London 1837, as an authority on shells.

[2] This word crossed out in MS.

here suppose these changes of adaptation greater than those hereditary ones which would elapse, during time such changes |

141–142 *excised.*

143 When one reads in Ehrenberg's Paper on Infusoria[1] on the enormous production — millions in few days — one doubt that one animal can really produce so great an effect. — the spirit of life must be every where ambient & merely determined to such points by the vital laws. — So that all characters originally may must have had the character of analogical. —

Gould says it is only in large groups where you have representations. — The aerial type in each family is relation to elements & not habits as shown by frigate Bird & flying Hawk. |

144 Gould[2] seemed to think, that widow bird replaced Birds of Paradise — if such fantastic sexual ornaments have so intimate a relation to two continents as to be called into existence in two continents our ignorance is indeed profound & such it appears. — Is there not some statement about diversity of form in aberrant circles — explained by such not having been long in blood? — |

145 My theory agrees with unequal distances between species some fine & some wide which is strange if creator had so created them. — People will argue & fortify their minds with such sentences as " oh turn a Buccinum into a Tiger " — but perhaps I feel the impossibility of this more than any one. — no turn the Zebra into the Quagga, let them be wild in same country with their own instinct (even though fertile[3] hybrids produced when compelled to breed) & then all that I want is granted. —

For at Galapagos make ten species of Orpheus, one of which has very short legs & long tail, short much curved beak. Other very long beak with short [tail] ; let them only have progeny with species & there will be two genera, — let short billed one be exaggerated & all rest destroyed, far remote genera will be produced. |

146 As we know from Ehrenberg[4] there are fossil (see scientific Memoirs & L'Institut) that there are Tertiary fossil Infusoria of same forms with recent & we have nothing to do with CREATION. —

The end of formation of species & genera is probably to add to quantum of life possible with certain preexisting laws. — If only one kind of plants not so many. — |

147–148 *excised.*

149 Mr Blyth[5] remark that a resemblance between some forms in birds is visible when young but not when old, — thus speckled form of young blackbird good remark if general. —

[1] Christian Gottfried Ehrenberg. " Recherches sur les Infusoires ", *Annales des Sciences Naturelles*, seconde série, tome 1 *Zoologie*, Paris 1834, p. 207 :—" La force réproductrice des animaux infusoires est plus développée que dans aucune autre classe d'êtres ".

[2] John Gould. The widow bird, which is a weaver, inhabits South Africa while the Birds of Paradise inhabit Australia. Gould's opinion was probably a personal communication to Darwin.

[3] This word crossed out in MS.

[4] Christian Gottfried Ehrenberg. " Paléontologie : infusoires fossiles du tripoli d'Oran ". *L' Institut*, tome 5, 1937, p. 330. " Remarks on the real occurrence of fossil Infusoria, and their extensive diffusion " *Scientific Memoirs*, vol. 1, 1837, p. 400.

[5] Edward Blyth. " Further remarks on the affinities of the feathered race ; and upon the nature of specific distinctions ", *Mag. Nat. Hist. Lond.*, vol. 9, 1836, p. 505. On p. 507 :—" The black bird has when young, a spotted breast ; and, in fact, the characters of its nestling plumage alone forbid its alienation from the spotted thrushes. Where, indeed, can we trace the line of separation between Mérula and Philomèla even? . . . "

Where any structure is general in all species in group we may suppose it is oldest, & therefore least subject to variation, — & good for generic divisions Ought genus to be founded on such characters as do not vary in the species of it : where does such occur?

Now some such characters rule are used by naturalists in their test of value of character. Therefore value of organ vary in different group & not known in single ones — viz. Macleay letter[1] to Fleming[2] p. 32 " where it (mode of generation) varies according to the species, it is manifestly of less importance as affording natural characters than among those groups, where it remains less subject to Variation ". Macleay's Rule is converse : value of character depends on non-variation & not on extension? these go together? |

150 Dr A. Smith[3] know lots of instances of replacement of one species by another, supply place in each others economy. Dr S. showed that savages are not born with any capacity for observation of tracks &c &c. Dr S. has some remarkable crochets about instincts whenever instinct is mentioned some definition must be given.

It would not be difficult to arrange children of same parents in a circle, — hermaphrodite & father & grandfather must be introduced & made young, father must be left out of case, that difference occurring. — |

151 It will be necessary to show hybridity from few forms, parents of all species not possible in some detail. the relation to islands close species on these isld &c will probably upset it. — The space which one branch of the tree of life occupied after its decay, will be occupied by the vigorous shoots from each branch no : because decay in that space is effect of unfavourable conditions (hence rise & depression of importance in each group & connection of even distant ones) the characters will be first those of analogy but will grow into affinity, but whether ever arrive at true
152 affinity doubtful. | A species is only fixed thing with reference to other living being. — One species may have passed through a thousand changes, keeping distinct from other, & if a first & last individual were put together, they would not according to all analogy breed together. — The bottom of the tree of life is utterly rotten & obliterated in the course of ages. —

As *species* is real thing with regard to contemporaries — fertility must settle it. —|

153 Changes in structure being necessarily excessively slow they become firmly embedded in the constitution, which other marked difference in the varieties made by of nature & man. —

The constitution being hereditary & fixed, certain physical changes at last become unfit, the animal cannot change quick enough & perishes. — Lyell has shown[4] such Physical changes will be unequally rapid with respect to their effects.

The Ægyptian animals domesticated?? & therefore most especially under care of man, & external circumstances not variable. — |

[1] William Sharp Macleay. "*A letter on the dying struggle of the Dichotomous system*", London 1830, p. 32.

[2] John Fleming, author of the *Philosophy of Zoology*, Edinburgh 1822.

[3] Andrew Smith, author of : *Report of the Expedition for exploring central Africa, from the Cape of Good Hope . . . 1834, under the superintendence of . . . A. Smith.* Cape Town 1836.

[4] Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 158 :—" Rate of the change of species cannot be uniform, however regular the action of the inorganic causes."

154 Animals have voice so has man. Not *saltus* but *hiatus* ; hence if sickness death, unequal life — stimulated by same passions, brought into the world same way, animals expression of countenance. They may convey much thus. Man has expression. — animals signals, (rabbit stamping ground), man signals. — animals understand the language. They know the cry of pain as well as we. —

It is our arrogance, to raise on the same shelf to look at common ancestor scarcely conceivable in savages precludes [?] any but instinct [?] feeling. Has not the white man, who has debased his nature by making slave of his fellow Black, often wished to consider him as other animal. — it is the way of mankind & I believe those who
155 soar above such prejudices yet have | justly exalted nature of man. like to think his origin godlike, at least every nation has done so as yet. —

We now know what is the natural arrangement. It is the classification of relationship, latter word meaning descent. —

A tree is taken by Fleming[1] as emblem of *dichotomous* arrangement which is false.

There is same difficulty in arranging animals in paper as drying plant, all brought
156 in one plane. | Fleming Quarterly review says[2] nat : fam : of willows contains many Linnaean genera. — How are the character which unite these of older standing that constant number of stamens in order or in next family ?

In considering fossil animals, what relation in *classification* in books, ought they to hold. —

Birds having web-feet when we see scarcely any traces of passage a difficulty but after all a slight one.

It will be necessary from manner Fleming treats subject to put in alternative of man created by distinct miracle. |

157 Macleay letter[3] to Dr. Fleming Philosophical Magazine & Annals 1830 (?) " if she has put man on the throne (*of reason*), she has also placed a series of animals on the steps that lead up to it " p. 20, between mammalia & fishes, one penguin, one tortoise, shows hiatus but not saltus. When Linnaeus[4] put whale between cow & hauk a frolicsome saltus p. 29. hiatus & saltus not syn[onymous]. — Linn : Transact.[5] vol. xiv. — p. 24. Lamarck bears to Cuvier that relation of theoretical astronomer to plain observer[6]. |

158 Macleay[7] seems to limit Lamarck definition of relations to settling the relative importance of the organs *in same state* in different animals. These questions may be all disputable, but the one end of classification to express relationship & by so doing discover the laws of change in organization. But the classification must *chiefly* rest

[1] John Fleming. *The Philosophy of Zoology*, vol. 2, Part III, p. 136 contains Fleming's views on classification. The reference to a tree is probably taken from William Sharp Macleay : " *A letter on the dying struggle of the Dichotomous System*, (London 1830), p. 8 : " Man in this system may be compared to the trunk of a tree, Dominies and D.D.s to the branches, and John Fleming to the bud or leaf on the spray ".

[2] John Fleming. Reference untraced.

[3] William Sharp Macleay. *A Letter on the dying struggle of the Dichotomous System*, London 1830, p. 20.

[4] William Sharp Macleay. *Ibid.*, p. 29. The reference is to : Carolus Linnaeus : *Systema Naturae*, Holmiae 1758. The last entry among the mammals on page 77 is *Delphinus* in the group Cete, after which immediately come the birds the first of which on page 86 are the Accipitres, beginning with *Vultur*.

[5] William Sharp Macleay. " Remarks on the identity of certain general laws which have been lately observed to regulate the natural Distribution of Insects and Fungi ", *Trans. Linn. Soc. Lond.*, vol. 14, 1825, p. 46.

[6] William Sharp Macleay. *A Letter on the dying struggle of the Dichotomous System*, London 1830, p. 24.

[7] William Sharp Macleay. *Ibid.*

on these same organs — habits, range &c &c — and the value of those organs when changed in different animals, — whether variation in eye of vertebrate afford better character than variations in eye of mollusc.

Macleay rests his whole groundwork of analogy on its concurrence in parallel parts of his series, i.e. cannot be discovered till circles completed.[1] |

159–162 *excised.*

163 N.B. Pyrrhoalauda (bird of St. Jago) of brown colour lives on ground, colour of habitation must have some effect. — Maldonado as good forests for beautiful birds. —

Hereditary ambling horses (if not looked at as instinctive) then must be owing to hereditary power of muscles. — Then we SEE structure gained by habit.

Talent &c in man not hereditary because crossed with women with pretty faces.

When horse goes a round the minute gets into the road at right angles how pleased it is just like man, emotions very similar. — Geolog. Transact. vol. V Birds bones in

164 strata of Tilgate forest.[2] | Seeing common gull in garden at Zoolog. Soc. its pale ash grey back like a black bird washed, whilst tips of primaries black, by examining series I cannot doubt laws of change will be known. — It appeared to me that half [breed] between fowls & pheasants is most like pheasant. I think so because viz. 3/4 bred (hence hybrids in this case have bred). White & common pheasants have crossed. — |

165 The attachment of dogs to man not altogether explained by F. Cuvier,[3] — Mem. Hensleigh's[4] objection. — it is more, he cuts the matter short by saying man cannot be companion but master. — Hereditary tameness as well as wildness — cf. Sir J. Sebright.[5] — Love of man gained & hereditary, problem solved.

Habits become important element in classification because structure has tendency to follow it, or it may be hereditary & strictly point out affinities. conduct of Gould,[6]

166 remark of D'Orbigny[7] point out importance of habits in classification. — | Thought (or desires more properly) being hereditary it is difficult to imagine it anything but structure of brain hereditary, analogy points out to this. — Love of the deity effect of organization, oh you materialist! — Read Barclay[8] on organization!! Avitism[9] in mental structure a disposition & avitism in corporeal structure are facts full of meaning. — Why is thought being a secretion of brain, more wonderful than gravity a property of matter? It is our arrogance, it our admiration of ourselves. — |

167 The idea of foetus being of one both sexes is strongly supported by wonderful fact of bees changing the sex by feeding. — no it is developing a hybrid female it is a wonderful relation going through all nature. — Makes hermaphroditism one step

[1] William Sharp Macleay. "Remarks on the identity of certain general laws which have been lately observed to regulat the natural Distribution of Insect and Fungi", *Trans. Linn. Soc. Lond.*, vol. 14 Part III, 1838, p. 46.

[2] Gideon Mantell. "On the Bones of Birds discovered in the Strata of Tilgate Forest in Sussex", (read 10 June 1835) *Trans. Geol. Soc. Lond.*, vol. 5, 1840, p. 175.

[3] Frédéric Cuvier. "Essay on the domestication of mammiferous animals . . ." *Edinb. New Phil. Journ.*, vol. 4, April 1828, p. 297.

[4] Hensleigh Wedgwood (1803–1891). Brother of Darwin's wife.

[5] Sir John Sebright. *Observations upon the instincts of Animals*, London 1836.

[6] John Gould. *The Birds of Europe*, London 1837.

[7] Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale*, tome 4, 3e partie, Paris 1835.

[8] John Barclay. *An Inquiry into the opinions, ancient and modern, concerning life and organization*, Edinburgh 1822.

[9] Avitism means relating to ancestors.

in series — in plants we have a step between monoecious & dioecious plants in animals it may be difficult to imagine how sexes were separated. — in plants we have some flower monoecious and other dioecious. Some flower hermaphrodites and others not???

The death of some forms & succession of others (which is almost proved, elephant has left no descendant in Europe, Toxodon in S. America) is absolutely necessary to explain genera & classes. if extinct forms were all fathers of present, then there
168 would be | perfect series or gradation. — It is easy to see if South America grew very much hotter, then Brazilian species would migrate southward being ready made, — and so destroy individuals, whereas in Falkland Is[d] they would change & make new species. — Alpine species being destroyed at Falkland Is[d]. — even at Falklands some probably would stand change better than others[1]. — Mem. Lyell hypothesis of change in Sicily.[2] — Splendid Harmony these views — did Lamarck connect extermination of some forms with his views.[3] — as genera are large probably only few of extinct |
169 forms have generated species & of 100 extinct species the greater number probably have no descendants on earth. —

The more complicated the animal the more subject to variation, therefore sexes in two animals : — When sexes are united (which probably is first stage) the tendency to change cannot be great, otherwise it would be unlimited.

We absolutely know the tendency is greater in Mammalia than in shells? univalves or bivalves. — |

170 Any man No. VI Magazine of Zoology & Botany p. 566 wants to see absurdity of Quinary arrangement let him look at abstract of Swainson[4] on classification. " Let anyone ever with a very superficial knowledge like myself of real affinities i.e. structure of the whole animal let him read Mr Swainson's on the Classification of animals & observe the character of the *demonstrations* offered of the singular views there offered, & he must be a zealous man in the cause if his faith not staggered." I confess no dissertation against these views could possibly have had & brought so much conviction to my mind. — |

171 Reflect much over my view of particular instinct being memory transmitted without consciousness, a most possible thing see man walking in sleep. — an action becomes habitual is probably first stage, & an habitual action implies want of consciousness & will & therefore may be called instinctive. — But why do some

[1] These eleven words on p. 169 of the MS. are marked to appear here.

[2] Charles Lyell. *Principles of Geology*. vol. 1, London 1830, Chapter VI in which Lyell proved by means of the fossil Mollusca of Sicily that the climate of the Northern Hemisphere had deteriorated.

[3] Jean-Baptiste-Pierre-Antoine de Monet de Lamarck. *Philosophie Zoologique*, tome 1, Paris 1809, p. 77 :—" Or, si quantité de ces coquilles fossiles se montrent avec des différences qui ne nous permettent pas, d'après les opinions admises, de les regarder comme des analogues des espèces avoisinantes que nous connaissons, s'ensuit-il nécessairement que ces coquilles appartiennent à des espèces réellement perdues? Pourquoi, d'ailleurs, seraient-elles perdues, dès que l'homme n'a pu opérer leurs destruction? Ne serait-il pas possible au contraire, que les individus fossiles dont il s'agit appartinssent à des espèces encore existantes, mais qui ont changé depuis et ont donné lieu aux espèces actuellement vivantes que nous en trouvons voisines. Les considérations qui suivent et nos observations dans le cours de cet ouvrage rendront cette conclusion très-probable " (p. 93 of 1873 reprint). Lamarck therefore did not connect his views with " extermination of some forms."

[4] William Swainson. Review and Critical Analysis. " 1. On the Geography and Classification of Animals. By William Swainson. 2. Classification of Quadrupeds. By William Swainson ". *Mag. Zool. Bot.*, vol. 1, 1837, p. 545. On p. 566 :—" We have no hesitation, however, in stating our conviction, that Mr. Swainson's theory, in regard to the analogies of this order, is the true one, . . . "

actions become hereditary & instinctive & not others. — We even see they must be done often to be habitual or of great importance to cause long memory, — structure is only gained slowly. Therefore it can only be those actions which *many* successive generations are impelled to do in same way. — The improvement of reason implies diversity & therefore would banish individual but general ones might yet be transmitted. — |

172 Memory springing up after long intervals of forgetfulness, — after sleep strong analogies with memory in offspring. or simply structure in brain people & senses recollecting things utterly forgotten — Some association in such cases recall the idea it is scarcely more wonderful that it should be remembered in next generation.

(N.B. What are those marvellous cases where you feel sure you have heard conversation before, is strong association recalling up image which had been past — so great an anomaly in structure of brain not probable), put note Sir W. Scott has written about it.[1] If we saw a child do some action which its father had done habitually we should exclaim it was instinct, even if savage taken & was given a great coat & this he put on & we afterwards could understand (language better instance) he had done this without reflection or consciousness of reasoning to tell back from front &c or use

173 of button holes it would | be instinctive. — My view of instinct explains its loss? if it explains its acquirement. — Analogy a bird can swim without being web footed yet with much practice & led on by circumstance it becomes web footed. Now man by effort of memory can remember how to swim after having once learnt, & if that was a regular contingency the brain would become web-footed & there would be no act of memory. — There is no correlation between individual objects as Ichneumon & caterpillar though our ignorance may make us think so, but only between laws.[1] |

174 Many diseases in common between man & animals. Hydrophobia &c cowpox, proof of common origin of man. — different contagious diseases, where habits of people nearly similar. Curious instance of differences in races of men. —

Wax of Ear, bitter perhaps to prevent insects lodging there. Now these exquisite adaptations can hardly be accounted for by my method of breeding, there must be some cor[r]elation, but the whole mechanism is so beautiful. The cor[r]elations are not, however, perfect, else one animal would not cause misery to other, — else smell of man would be disagreeable to mosquitoes. |

175 We never may be able to trace the steps by which the organization of the eye passed from simpler stages to more perfect preserving its relations. — the wonderful power of adaptation given to organization. — This really perhaps greatest difficulty to whole theory. —

There is breed of tailless cats, near Bath, Lonsdale[2] ditto says sheep could not live for some time at New York instance of the fine relation of adaptation of animals & the country they inhabit, — & the first one that bred one was diseased in its loins

176 & all were so afterwards (forgets authority). — | Lonsdale is ready to admit permanent small alterations in wild animals & thinks Lyell has overlooked argument

[1] This sentence in square brackets in MS.

[2] William Lonsdale was Curator of the Geological Society's collections. The information about tailless cats was probably a personal communication.

that domesticated animals change a little with external influence, & if those changes permanent so would the change in animal be permanent. — It will be easy to prove persistent varieties in wild animals, but how to show species. — I fear argument must rest upon analogy & absence of variates in a wild state — it may be said argument will explain very close species in isld near continent, must we resort to quite different
177 origin when species rather further. — Once grant good species as | carrion crow & rook formed by descent or two of the willow wrens &c &c & analogy will necessarily explain the rest. —

Lonsdale says[1] he has seen in old Book last Bear in England killed in year 1000, reference to succession of types? different species ; Horses &c.

State broadly scarcely any novelty in my theory, only slight differences, the opinion of many people in conversation. The whole object of the book is its proof, its limiting the allowing at same time true species & its adaption to classification &
178 affinities its extension. — | Von Buch Travels p. 302 account of trees[2] ceasing to grow far N. become stunted, altered & low fertility — more sickness?? because offspring too unlike.?? Memoir of Charles D'Orbigny on Plastic Clay of Paris[3] contains many genera of Pachydermata or & other mammals, otter, civet cat, rodents. — (Pachyderm in Portland stone of Alps!!!? No) p. 15 (Lyell's pamphlet).[4]

Is man more hairy than woman because ancestors so, or has he assumed that character, — female & young seem most like mean character the others assumed. — Daines Barrington[5] says cock birds attract females by song do they by beauty, analogy of man if so war not |

179–188 *excised.*

189 p. 428 ouzel sometimes builds nest without dome[6] vol. 9 Mag. Z. & B.

p. 431 Missel thrush lately increased in numbers over whole of England & Ireland.[7] — Curious in so wild bird. —

Annals of Natural History Vol. I p. 185 case of tit lark placing withered grass over nest when often looked at.[8] — This most puzzling whether instinct or reason??

[1] William Lonsdale. Personal communication. There is a tradition that the last British bear was killed in Scotland in 1057.

[2] Leopold von Buch. *Reise durch Norwegen und Lappland*, Zweiter Theil, 1810. The account of trees is on pages 295–302.

[3] Charles d'Orbigny. " Existence d'un étage de calcaire marin particulier au-dessous du terrain tertiaire du bassin de Paris, et d'une assise, également nouvelle, dépendant de l'argile plastique ; découverte d'ossements fossiles dans ce dernier étage." *Comptes Rendus Acad. Sci.*, Paris, tome 3, 1836, p. 228.

[4] Charles Lyell ; presumably the reference is to a reprint of " On the strata of the plastic clay formation exhibited in the cliffs between Christchurch Head, Hampshire, and Studland Bay, Dorsetshire." *Trans. Geol. Soc. Lond.*, vol. 2, 1829, p. 279.

[5] The Hon. Daines Barrington. " *Experiments and Observations* on the singing of birds',' *Phil. Trans. Roy. Soc.*, vol. 63, 1773, p. 243.

[6] William Thompson. " Contributions to the natural history of Ireland. No. 4 On the Birds of the order Insessores. The Water Ouzel ". *Mag. Zool. Bot.*, vol. 2, 1838, p. 427. On page 429 :—" The first nest of this bird I remarked was placed in a hole in the clayey bank of a pond, where, owing to the shelter afforded, there was no occasion for the display of its domed architecture, and this was consequently dispensed with."

[7] William Thompson. "Contributions to the natural history of Ireland, No. 4 On the Birds of the order Insessores. The Mistle-Thrush." *Mag. Zool. Bot.*, vol. 2, 1838, p. 427. On p. 431 :—" Has of late years extended its locality in Ireland, as in other parts of the British Islands, and is now found throughout the country."

[8] William Thompson. " Contributions to the natural history of Ireland. No. 6 On the Birds of the order Insessores." *Ann. Nat. Hist.*, vol. 1, 1838, p. 181. On p. 185 :—" . . . he observed a quantity of withered grass laid regularly across the nest. . . . " This remark is however made in respect of the meadow pipit.

Gould says[1] he believes that he has seen half fox & dog & that it was most like fox. — He felt sure the half breed of Australian dogs would be most like Australian. — Curious this ready answer without any leading question. — This might be mentioned in note. — |

190 Try to trace from simplest reasoning in lower animals many times produced, a general tendency produced, such as man getting habitually into passion, becomes habitually passionate. — The key to the affections might perhaps thus be found — a person who is habitually kind to children increases general instinctive feeling. — |

191 There is great difficulty in making an alpine species from one in lower country during gradual elevation of isl[d]. — We must imagine a considerable range of one species on a mountain side of which the central parts become occupied by a third best adapted kind. — Lower species would then revert to pristine form (which must have been altered by crossing with alpine form). Lower species afterwards would probably often be destroyed, — or regrafted with fresh arrivals &c &c. — Climate altering as island increases, — upper parts attracting all the moisture. |

192 Henslow thinks[2] if leaf of plant varies, all organs vary in plant. The variation in character of leaf of plant is remarkable what is analogous to it in animals? —

Babington says[3] in most plants, even those on Guernsey & on West Coast of Ireland, are absolutely (& who better authority) similar with those over whole of country. — Some species are larger &c in different countries. These facts show how very per-

193 manent plants | are, & this conclusion must be arrived at, when one sees a plant like Paris quadrifolium growing in one wood far from any other plants of same species.

Channel Isl. (& probably Isle of Man) no plants peculiar to themselves, this remarkable compare it with Canary Isld, Galapagos. — Iceland has same uni-

194 formity. | Primrose & Cowslip quite wild but they affect different localities, — latter on banks & in damp parts, both propagated by seeds. — There are two Dandelions which just lately have been shown to be same — one grows in marsh & other dry ; yet if T. *palustris* be sown in dry station it will for some generation come up so. — There are not many intermediate shades in these case, but absolute species formed. The Anagallis perhaps offers another case of permanent varieties in wild state. —

195 The two | former produced by difference of station. Varieties chiefly produced by cultivating parent in *rich* soils & then seeds produce variety.

Wild carrot made into biennial domesticated kind with large root by sowing it at wrong time of year & manuring it. — Epigonous & perigonous are very important in classification. Here we have generative organs first character.

In dioecious plants many of the female flowers unimpregnated Babington.[4] |

196 We see gradation to mans mind in Vertebrate Kingdom, in more instincts in rodents than in other animals ; & again in mans mind, in different races being unequally developed. — ? is not elephant intellectually developed amongst Pachydermata like man amongst monkeys or dog in Carnivora. —

[1] John Gould. Probably personal communication.
[2] John Stevens Henslow. Probably personal communication.
[3] Charles Cardale Babington. " A notice, with the results, of a Botanical Expedition to Guernsey and Jersey in July and August 1837 ", *Mag. Zool. Bot.*, vol. 2, 1838, p. 397.
[4] Charles Cardale Babington. Reference untraced.

Man in his arrogance thinks himself a great work worthy the interposition of a
197 deity. more humble & I believe truer to | consider him created from animals.

Insects shamming death most difficult case to imagine how art acquired. — Only reason however on this to a degree. Mem. spider only dropping where ground thick. — Shamming death it is but being motionless. How is instinctive dread it is exceedingly doubtful whether animals have any fear of death or of pain of death acquired? The S. American dung beetles will each become the father of many species, a few eggs transported to the St. of Magellan. — Change of habits in Van Diemens Land. |

198 Study Mr. Blyths papers on Instinct.[1] — His distinction between reason & instinct very just; but these faculties being viewed as replacing each other it is hiatus & not saltus. —

The greater individuality of mind in man is analogous to greater individuality of bodies of some animals over those of others. — The mind of different animals less divided. — But as man has hereditary tendencies, his mind is still only, divided body.

P. 3 language seems to supply instincts, — & those powers which allow of acquirement of language hereditary, acquirable. — therefore mans mind not so different from that of brutes.

Hard to say what is instinct in animals & what reason, in precisely same way not possible to say what habitual in man & what reasonable. Some action may be either in same individual. |

199 P. 7, is not squirrel hoarding & killing grain acquirable through hoarding from short time. — My theory must encounter all these difficulties, knowing that animals have some reason, & actions habitual. it surely is not worthy interposition of deity to teach squirrel to kill ears of corn. According to my views, habits give structure, ∴ habits precede structure, ∴ habitual instincts precede structure. — duckling runs to water before it is conscious of web-feet. —

P. 7 Mr. Blyths arguments[2] against squirrel using reason in hiding its food is applicable to any habitual action even which man performs, — child striking a post in passion. —

Habit instinct gained during life. — do elephants easily acquire habits is this the key to their mental powers?

p. 8 mistakes of instinct are external contingencies where the habit is not applicable. |

200 The degree of development of all animals of same class being about equal, — organs of generation about equally complicated. —

An Entomologist going into a country & collecting thousands & tens of thousands new insects, perhaps scarcely one new family & no new order. — Wonderful, partly explained on my theory, & otherwise mere fact creator chooses so to create. —

It is very remarkable, with so much death, as has gone on, no greater gaps. — External conditions to be sure have remained somewhat similar. — !!! |

201 My theory drives me to say that there can be no animal at present time having an

[1] Edward Blyth. "On the Psychological distinctions between Man and all other animals; and the consequent Diversity of Human Influence over the inferior ranks of Creation, from any mutual and reciprocal Influence exercised among the latter." *Mag. Nat. Hist. Lond.*, vol. 1, 1837, p. 1.

[2] Edward Blyth. *Ibid.*

intermediate affinity between two classes. — there may be some descendant of some intermediate link. — the only connection between two such classes will be those of analogy, which when sufficiently multiplied become affinity yet often retaining a family likeness, & this I believe the case. — Any animal really connecting the fish & mammalia must be sprung from some source anterior to giving off of these two families, but we see analogies between fish. — Birds same remarks. |

202 Characters of analogy, — last acquired, — or aberrant, therefore more easily modified. — This is not easily told, for any small family having analogous characters, might be multiplied. — We must argue reversely : *where character variable* it is (one of analogy or) *lately acquired.* In pigs number of vertebrae subject to variation therefore lately acquired.

I fear great evil from vast opposition in opinion on all subjects of classification, I must work out hypothesis & compare it with results ; if I acted otherwise my premises would be disputed. — According to Principle of last page osculant groups between two circles of equal value must be so from characters of analogy. — See my notes on p. 37 of Macleay.[1] Wonderfully accordant with fact there stated only in most discordant groups. |

203 The formation of genera may sometimes be due to accident as submersion of land containing all of intermediate Father-species, & not, therefore, solely owing to such interm. father-species being little adapted to some physical change. — If Patagonia became fertile all intermediate species living there would be destroyed, & N. & S. existing species become fathers of genera — Whatever the cause is, any osculant species which survived would be few in number. —

204 Parallel of Japan, near Himalaya, & European forms on that Isl[d]. | The *races* of men differ chiefly in colour, form of head & features (hence intellect? & what kinds of intellect) quantity & kind of hair forms of legs — hence the father of mankind probably possessed a structure in these points for a less time than other points. — female genital organs, — make abstract on this subject from Lawrence,[2] Blumenbach[3] & Prichard.[4] In some monkeys clitoris wonderfully produced. — Now we might expect that animal half way between man & monkey would have differed in hair colour & form of head & features ; but likewise in length of extremities, how are men in this respect upper & lower, which I do not know whether it differs in present races, & form of feet.—Negro or father of negro probably was first black at base of nails & on white of eyes. —

Will he say creation is at end seeing that Tertiary geology has obeyed rules of modern causes & considering over the vicissitudes of present animals. He would be bold. I will venture to say unphilosophical. |

207 A question of immense difficulty is whether Apterix descend from same parent with other birds, or branched off anteriorly. think what principles are there to guide in this opinion? *Excellent principle of abortion.*

[1] William Sharp Macleay. *Horae Entomologicae,* London 1819, p. 37 :—" These genera I propose to call *osculantia,* from their occurring as it were at the point where the circles touch one another ".

[2] William Lawrence. *Lectures on physiology, zoology, and the natural history of man,* London 1819. This edition was suppressed.

[3] Johann Friedrich Blumenbach. *A Manual of the Elements of Natural History.* London 1825.

[4] James Cowles Prichard. *Researches into the physical history of Man,* London 1813.

Isolation of range tends to alteration view. — ostriches ditto but then there may have existed series between Apterix & other birds. — Will having many trifling characters in common with other birds reveal the secret. — Now all the different forms of Synallaxis trifling characters as red band on wing show to be from one parent — same form of beak &c without these trifles, it would not then be told whether not descended
208 from long way back. — aberrant forms produced when many species | but when much death, may be inferred much time elapsed &, therefore descended from branch high up. — Such probabilities only guides. — Yet trifles are produced by circumstances. *Spines* on Echidna, when it can be traced through series then probably hereditary & not produced by circumstances.

In Ostrich which is not isolated we must suppose the changes from typical structure have either been more rapid than in all other birds, or that it sprung from a branch high up. This argument not applicable to Apterix, but source of error for only |
209–210 *excised.*

211 organic matter — have & which thinking principle seems to be given a assumed according to a more extended relations of the individuals, whereby choice with memory *or reason*? is necessary — which is modified into endless forms bearing a close relation in degree & kind to the endless forms of the living beings. We see thus unity in thinking and acting principle in the various shades of separation between those individuals thus endowed & the community of mind even in the tendency to delicate emotions between races. — recurrent habits in animals. —

Animal magnetism principle of irritation, *sleep walking*, fits, laughter, &c &c. Man & man may have some relation together as well as man & child, polypus &
212 polypus, bud & bud, polypus & germ, plant & seed. — | Instincts in young animals well developed, just like habits easily gained in childhood. — Young salmon first a species which lived in estuaries. its tastes taught it to go to salter water (& its necessities teach it taste, but that a much more general argument) & therefore down the stream follow ebb tide, therefore got into habit of going down stream which would last were the stream 1000 miles long.

A monkey (Baboon) at Z. garden upon being beaten behaved very differently from a dog, more like man. continued long in a passion & looked out for him to come again, very different from dog, perhaps being in passion chief difference. |
213–216 *excised.*

217 before, then there always have been gaps, & there now must be, ∴ extinction of species bears relation to existence of genera &c &c. Discussion useless, until it were fixed what a species means. Two savages, two species, — civilized man may exclaim with Christians we are all Brothers in spirit, all children of one father, — yet differences carried a long way.

Case of habit : I kept my tea in right hand side for some months, & then when that was finished kept it in left, but I always for a week took of[f] cover of right side though my hand would sometimes vibrate seeing no tea brought back memory — old habit of putting tea in pot, made me go to tea chest almost unconsciously. — Why do absent [minded] Dr Black tea & sugar people reverse habits. |

218 Insects & birds are the only two tribes fitted for water, air & land (Macleay has this remark).

Mem. number 5 here most evident!!? Examine into this case. L[d] Jeffrey[1] (Life of Mackintosh, vol. II, p. 495) — ["] in fact in all reasonings of which human nature is the object, there is really no natural starting place, because there is nothing more elementary than that complex nature itself with which our speculations must end as well as begin" &c &c. The centre is everywhere & the circumference nowhere as long as this is so — !! Metaphysics!!! |

219 Mrs. Somerville[2] connection of Phisical sciences p. 276 may be worth glancing at as she has no original idea, it will show state of knowledge. Negros existed since time of earliest Egyptian drawings & Old Testament.

Domesticated animals having *same* idiosyncrasy, cause of fertility. — varieties not produced as by nature, if so the habits which would have formed them would have arisen under different climates &c. Do I mean that idiosyncrasy of wild animals is generally different, because this difference arises a good deal from climate & habits, & therefore less fertile according to Mr Herbert's views.[3]

Argue case of abortive organs to mules in their genitals & even to a limb not used.

The only cause of similarity in individuals we know of is relationship, children of one parent, races of animals — argue opening case thus. |

220 Educate all classes, avoid the contamination of castes, improve the women (double influence) & mankind must improve. —

The areas of subsidence marked out by animals of same genera is not equal to areas of elevation: marked out by existence of elevated extinct? genera of shells. — duration in the classes however different. — |

221–2 *excised.*

223 & hereditary & such definite thoughts, I will never allow that because there is a chasm between man (— & chasms necessary consequence of to account for the scheme of nature) and animals that man has different origin.

Dr Royle[4] Royal Institution seems to think Botanical Provinces will turn out not nearly so confined as now thought. — N. American, European, & Chinese genera & some species in Himalaya, some English beetle, birds & a fox most close. |

224 The most curious case is saxifrage, almost closely allied species Himalaya, 13000 & Melville Is[d]. —

West Africa & India some plants same.

[1] Lord Francis Jeffrey. Robert James Mackintosh: *Memoirs of the Life of the Right Honourable Sir James Mackintosh*, London 1836. In chapter VIII there is a letter to the editor by The Hon. Lord Jeffrey, p. 491. Darwin's quotation is on p. 496 of the second edition.

[2] Mary Somerville. *On the connexion of the physical sciences.* London 1834. [from the 3rd edition, London 1836, p. 286] :—" . . . nothing is more remarkable than the distinctions which characterise the different tribes of mankind, from the ebony skin of the torrid zone to the fair and ruddy complexion of Scandinavia, — a difference which existed in the earliest recorded times, since the African is represented in sacred writing to have been as black as he is at the present day, and the most ancient Egyptian paintings confirm that truth; yet it appears from a comparison of the principal circumstances relating to the animal economy or physical character of the various tribes of mankind, that the different races are identical in species. Many attempts have been made to trace the various tribes back to a common origin, by collating the numerous languages which are, or have been spoken. . . . "

[3] William Herbert. *Amaryllidaceae; preceded by an attempt to arrange the Monocotyledonous orders, and following the Treatise on Cross-bred Vegetables, and Supplement*, London 1837, p. 343.

[4] John Forbes Royle. " Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere ". *Journ. Roy. Geogr. Soc. Lond.*, vol. 5, 1835, p. 361. The significance of the words " Royal Institution " is not clear.

America. See Brown Congo Expedition :[1] 400 Australian plants found in other parts of world.

Athenaeum June 3d 1838 quotes Mr. Turpins[2] assertion that globules of milk produce a plant capable of growing!! & propagating itself.

In Tropical countries (as St. Jago Cape de Verdes) the shells in equal periods with Europe would probably have changed much less. — Here is an |

225–230 *excised.*

231 Henry Thompson[3] tells me best way to improve cattle is to cross between a good bull & the provincial breed, & the first offspring thus produced are better than those bred in & in, — which looks as if qualities were not permanent in the new cross. — In the Bantam clubs they used to fix on the kind wanted, colouring of each feather, weight & size & they would produce number agreeing almost to the point in question. — Merely picking opposite qualities, with no other means whatever. — |

232 Individual man & animals could only exist by habit — therefore same principle transferable not wonderful.

According to my view because actions are constant they are instincts and not ∴ instincts constant.

? whether mutilations non-hereditary & variation produced in short time in some extent counterpart, mutilation being variation produced in shortest possible time.

Mr. Willis[4] long-eared little dogs, I am told, go to heat, take dog but do not become

233 impregnated | & puppies delicate. — they cross sister & brother of same litter, those of different litters or of father & child are thought to be unhealthy — puppies become very small, idiots, & bandy legged by this long breeding in. Hope[5] says must not trust him that genus of parasite to genus of animals different (p. 234), different species to different, — inguinal louse African — European different. — those 2 breeds differ Africa Australia.

Parasites die when brought over on tropical animals, which account for the species changing ∴ because mammalia can subsist where parasite [. . ?].

Read Entomological Transactions. |

234 Why if louse created should not new genus have been made, & only species. Good argument for origin of man one. —

Is the *extinction* & *change of species* two very different considerations. with respect to law of mammals shorter duration than molluscs. argue case both in Europe & S. America. very difficult case. Does this law of duration apply to utter extinction

[1] Robert Brown. " Observations, Systematical and Geographical, on Professor Christian Smith's collection of Plants from the Vicinity of the River Congo ", *Narrative of an Expedition to explore the River Zaire, usually called the Congo in South Africa in* 1816 *under the direction of Captain J. K. Tuckey, R.N.*, London 1818, Appendix v, p. 420.

[2] Jean-Pierre-François Turpin. " Recherches microscopiques sur l'organisation et la vitalité des globules du lait; sur leur germination, leur développement et leur transformation en un végétal rameux et articulé." *Comptes Rendus Acad. Sci.*, Paris tome 5, 1837, pp. 822–837. Darwin's reference to the *Athenaeum* of 3 June 1838 is incorrect, and should read June 2 where on page 396 M. Turpin's assertion is quoted.

[3] Henry Thompson. Unidentified.

[4] Mr. Willis was the name of the hairdresser in Great Marlborough Street where Darwin was then living at No. 36. His Third Notebook on the Transmutation of Species (p. 163) has another reference to the breeding of dogs.

[5] Frederick William Hope. The reference is presumably : " On Insects and their larvae occasionally found in the Human Body ". *Trans. Entom. Soc. Lond.*, vol. 2, 1837–40, p. 256.

or rapidity of specific change? he first would be called generic & other specific extinction. — |

235 In the Entomostraca[1] (Magazine of Zoology & Botany) where several generations are produced in succession (13?) without impregnation, therefore sexual passion must arise after long interval, very good case. — habit is awakened by association (case of Elephant which had run wild in India in Heber?)[2] is analogous to dormant instinct. — (How wonderful a case bees developing sex of neuters). Species may have had their infancies as well as men, when habits much more firmly impressed we see in the Entomostraca. The sexual curiosity of the orang outang (in June 1838[]] when young male was added good instance of instinct showing itself, not from instruction. |

236 Even the action of the viscera under sympathetic nerve may be instinct or habits. ? Are sympathetic nerves & nervous system of insects analogous? — Even plants have *habitual* actions. — this very important in considering how children come to suck or other actions in foetus of mammalia, or chick eat.

Generation becomes necessary when organs of parent are concentrated in different parts & scission cannot effect the process. — scission in all cases probably gemmation (*Ehrenberg*) but why two sexes — not necessary to generation (latent with no relation to time) as in buds. — I can scarcely doubt final cause is the adaptation of species to circumstances by principles, which I have given |

237–242 *excised.*

243 Study Bell on Expression[3] & the Zoonomia[4], for if the former shows that if a man grinning is to expose his canine teeth (this may be made a capital argument if man does move muscles for uncovering canines), no doubt a habit gained by formerly being a baboon with great canine teeth. — Blend this argument with his having canine teeth at all. — This way of viewing the subject important. — Laughing modified barking, smiling modified laughing. Barking to tell other animals in associated kinds of good news, discovery of prey. arising no doubt from want of assistance. — crying is a puzzler. — Under this point of view expression of all animals becomes very curious — a dog snarling in play. — |

244 Hensleigh[5] says the love of the deity and thought of him or eternity only difference between the mind of man & animals. — yet how faint in a Fuegian or Australian! Why not gradation. — No greater difficulty for Deity to choose when perfect enough for future state, that when good enough for Heaven or bad enough for Hell. — Glimpses bursting on mind & giving rise to the wildest imagination & superstition. — York Minster story of storm of snow after his brothers murder, — good anecdote.[6]

[1] William Baird. " The Natural History of the British Entomostraca ", *Mag. Zool. Bot.*, vol. 1, 1837, pp. 35, 309, 514. On p. 522 :—" They must either therefore, be hermaphrodite, or, as in some other genera, as the Daphnia for instance, one copulation suffices not only to impregnate the female for life, but succeeding generations also."

[2] Reginald Heber. *Journey through the Upper Provinces of India, from Calcutta to Bombay*, 1824–5, (*with notes on Ceylon*) ; *to Madras & South Provinces*, 1826, *& Letters written in India.* London 1828.

[3] Sir Charles Bell. *Anatomy and Philosophy of Expression*, London 1806. Darwin referred to this subject in his *Expression of the Emotions in Man and Animals* (London 1872) on pp. 250–1.

[4] Erasmus Darwin. *Zoonomia ; or, the Laws of Organic Life &c.* London 1794–6.

[5] Hensleigh Wedgwood. Brother of Darwin's wife.

[6] Charles Darwin. *The Descent of Man and selection in relation to Sex.* London 1871, p. 67 :—" [York Minster] related how, when his brother killed a ' wild man ', storms long raged, much rain and snow fell."

Sowerby.[1] Geographical range, shells, like cryptogamic plants, of marine kinds. there are some restricted genera, but then they appears always very small ones as Trigonia in Australia or Concholepas in America. — yet many countries have far
245 more species than other countries (*[2] p. 246) | as Cyclostoma in Phillippines & Amphidroma in S. America. — yet there are a few Cyclostomes & a few Amphidromas. —

This is remarkable. —

Fish & drift sea weed may transport ova of shells. — Conchifera hermaphrodite, *eggs in groups*. Have dioecious plants more restricted ranges than other plants. —

Many same genera confined to hot countries & many to cold. — Hence latitude is more important element than longitude. But in land & f[resh] w[ater] shells there is more confinement, thus the Naiads (study de Ferussac)[3] are confined to S. America.
246 — Mr. Sowerby says | there are some shells common to West coast of Afria & E.S. America. — get instances. — very good anomaly in range.

* [4]What circumstances have led to formation of some species some few have been scattered over whole world.

Many shells at present day same (or according to Sowerby fine species) on coasts of N. America & England — but the fossils are not like, except in very few cases, |
247 those of Tertiary European fossils — (so much the more remarkable, ∴ Carboniferous ones similar?). Now this is very remarkable (connect these facts with identity of land animals. these however come from Siberia). — It cannot be said American fossils more resemble those of America than of Europe, because the recent ones are so close.

Was there continent between N. America & Europe? — *Norton*[5] has written on fossils of N. America. — |

248 At the end of "*White's Selbourne*"[6] many references very good. Also "*Rays Wisdom of God*"[7]. Often refer to these. — Also some few facts at end of "The British Aviary"[8] or Bird Keepers Companion. Study *Appendix* (& only appendix) of Congo Expedition.[9] |

249–254 *excised.*

255 gradually separated the birds might yet remember which way to fly. There is a kind of wren (Bebyk??) which seems common in Rocky mountains & on one lofty isolated spot on the Alleghanies to which it migrates every year; probably a chance wanderer like the first pair of Pipe flycatcher. —

[1] James Sowerby. *The Genera of Recent and Fossil Shells, for the use of students in Conchology and Geology*, London 1820–5.

[2] This asterisk refers to the passage marked by an asterisk on page 246 of the manuscript below.

[3] André-Etienne-Justin-Pascal-Joseph-François D'Audebard de Ferussac. *Histoire Naturelle et particulière des Mollusques terrestres et fluviatiles*, Paris 1819–51.

[4] This asterisk marks the beginning of the sentence referred to on page 244 of the manuscript above.

[5] Reference untraced.

[6] Gilbert White. *The Natural History and Antiquity of Selborne, in the country of Southampton: with engravings and an appendix*, London 1789.

[7] John Ray. *The Wisdom of God manifested in the works of Creation*, London 1691.

[8] *The British Aviary*, London n.d.

[9] Robert Brown. "Observations, Systematical and Geographical, on Professor Christian Smith's Collection of Plants from the Vicinity of the River Congo", *Narrative of an Expedition to explore the River Zaire, usually called the Congo in South Africa in* 1816 *under the direction of Captain J. K. Tuckey, R.N.* London 1818 Appendix v, p. 420.

Bachman[1] says he thinks the Mocking thrush beats all English birds in song. — one of their thrushes exceeds our blackbird, but our blackbird exceeds their other
256 thrushes, — yet they have one with very sweet notes. — | Their soft-billed birds are inferior to ours, & our lark ranks very high. — Upon the whole thinks more birds sing in England than in America, but the few of N. America are quite as beautiful. The thrushes of N. America singing so well & the mocking thrush being so very beautiful great contrast with South America. — |

257–258 *excised.*

259–264 *blank.*

265[2] Books quoted by *Herbert* p. 338

Schiede in 1825 & Lasch. Linn. in 1829 has given list of Spontaneous Hybrids. where ?

Sweet. Hortus Britannicus has remarks on acclimatizing of Plants.

Herbert p. 348 gives reference to Kohlreuter's Papers

Wiegman has published German pamphlet on crossing Oats, &c

Mr. Coxe " Views of the Cultivation of Fruit trees in N. America " in Lib. of Hort. Soc.[3]

Mc Neil has written good article on Horticulture in Edinburgh Encyclop. — Horticulture Journal

The British & Foreign Medical Review No. XIV April 1839. — Review on " Walker on intermarriage ", price 14s.

March 20th 1839. Philosophy of Blushing lately advertised /6s

Mrs. Necker on Education preeminently worthy of studying in metaphysical point of view

Henslow has list of plants of Mauritius with locality in which each one is found. Very good to see whether peculiar plants in high points |

266 Institution of Paris with respect to licentiousness destroying children, — it is not effect, as Lyell suggested, of organs being worn out as otherwise old couple would not have children

Turner's embassy to Thibet, perhaps worth reading, quoted by Malthus. —

Heberdens Observat. on increase & decrease of different diseases 4to 1801. — quoted by ditto. —

There appears to be good art. on Entozoa by Owen in Encyclop. of Anat & Physiology. —

Dampier probably worth reading

Lessings Laocoon (translated in 1837) on limits of painting & poetry. — Erasmus thinks I should like it.

The Sportsman's Repository 4to contains much on dogs. —

Reports of Brit. Assoc. — some important Papers.

Dr Mayo. Pathology of Human Mind. —

[1] John Bachman. Reference untraced.

[2] From this point the succession of pages is inverted, because Darwin wrote these pages by working forwards from the end of the notebook.

[3] William Cox of Burlington, New Jersey. *A view of the cultivation of fruit trees, and the management of orchards and cider*, Philadelphia 1817.

Audubons Ornithological Biography 4 volumes well worth reading
Bevans work on Bees, new edit 1838
Harlaam [Harlan] Physical & Medical Researches on Horse in N. America. — Owen has it —
Ld. Brougham. Dissertations on subject of Science connecting with Natural Theology, — on instinct & animal intelligence, — *very good.*
Endlicher has published in first volume of annalen of Vienna, sketch of South sea Botany
R. Brown has curious *coloured* maps by Copenhagen Botanist of range of plants |
267 Silliman's [American] Journal [of Science]
Rengger on Mammalia of Paraguay, account wild cattle &c
Montagu on birds (facts about close species).
Wilson's American Ornithology
Read Aristotle to see whether any my views is ancient?
Study with profound care *abortive* organs produced in domesticated plants, where function has ceased to be used as tendril into stump
Library of Useful Knowledge, Horse, Cow, Sheep
Vesey Philosophie d'Histoire Naturelle
Marcel de Serres Cavernes d'Ossements 3rd edit. Octavo (good to trace European forms compared with African)
Annals [of natural history]
Histoire Generalle et Particuliere des Anomalies de l'organization des Hommes et les animaux. by Isid. Geoffroy St. Hilaire 1832 contains also his fathers views. Quoted by Owen. —
Hunter has written quarto works on physiology besides the papers collected by Owen (at Shrewsbury)
Yarrells Paper on change of plumage in the Pheasants Philosoph Transactions 1827 [vol. 118]
Paxton on the culture of Dahlias
Mrs. Gore on roses might be worth consult.
Paper on Consciousness in Brutes in Blackwood, June 1838
H. C. Watson on Geograph. Distrib : of British Plants.
Humes Essay on H[uman] Understanding (some time)
Du[gald] Stewart works & lives of Reid, Smith & giving abstracts of their views
Mackintosh Ethnical [Ethical] Philos : |
268. To be read
Humbold[t]. New Spain — much about *castes* &c
Richardson's Fauna Borealis
Entomological Magazine (paper on geograph range)
Study Buffon on Varieties Domesticated animals see if laws cannot be made out
Find out from Statistical Society where M. Quetelet has published his laws about sexes relative to age of marriages
Brown at end of Flinders & at end of the Congo Voyage
Decandolle Philosophie on Geographical distrib in Dict. Sciences Nat. in Geolog Soc.
F. Cuvier on instinct

L. Jenyns paper in Annals of Nat. History
Prichard. — Lawrence
Roy St. Vincent vol. iii p. 164 on unfixed form.
Dr Royle on Himalaya types.
Smellie. Philosophy of Zoology
Flemming. ditto
Falconers remark on the influence of climate
Whites regular gradation in Man.
Lindleys introduction to the Natural System
Bevan on honey bee
Dutrochet memoires sur les vegetaux et animaux — on *sleep* & movements of Plants £1 . 4s
Voyage aux terres Australes chapt. xxxix, tom iv. p. 273 [Peron . . .]
Latreille Geographie des insectes 8° p. 181
Sept. 17 [1839] For references to authors about E. Indian Islands consult Dr Horsfield |
269 Sir G. Staunton's Embassy to China Oct. 12th [1838]
Kotzebues two voyages, *skimmed well* ditto
Lutkes Voyage, carefully read. —
Reynolds Discourses
Lessings Laocoon
Whewell's inductive History. References at end of each vol
Herschel's introduction to Natural Philosophy
R. W. Darwin's Botany. — references at end
Mayo Pathology of the Human Mind
Evelyn's Sylva, skimmed stupid
Brown's travels in Africa ; well skimmed.
1839
Jan. 10th All Life of W. Scott, except the V volume
— 19th Mungo Parks Travels
Feb. 12 Sir H. Davy Consolations in travels
— Observations on morals of Eugenius
— 14th Boswells Life of Johnson 4 vols.
25th Philips Geology, 2nd vol. —
March 16 Gardner's Music of Nature
— Herbert on Hybrid mixture : marginal notes.
— 20th Carlyle's French Revolution 3 ? vols oct :
— 26th Blumenbach's Essay on Generation. English Transla.
— The Rev. A. Wells Lecture on instinct
— Clive on the Breeding of animals
— Spallanzanis Essay on Animal Reproduction
— Treatise on Domestic pidgeons
— 30th Lives of Hayd[n] & Mozart
April 25th Lockarts Life of Napoleon.
,, 5th Dr Edwards influence of physical causes, well skimmed

— Bartrams travels in N. America
May 18th Stanley familiar History of Birds
— Mackintosh's Ethical Philosophy
— Bell's Bridgewater Treatise
— Wilkinson's Egyptian remains skimmed
— Pliny Nat. Hist of world ditto
,, ,, Lamarck II vol Philos. Zoology references at end of each chapter
Crabbes Life
June 1st King & Fitzroy |
270 Rays Wisdom of [God]
Lisiansky's Voyage round World. 1803–6. nothing
Lyells Elements of Geology
Gibbons Life on himself
Hume's ditto with correspond. with Rousseau
Miss Martineau How to observe
Mayo Philosophy of Art of Living
Several of Walter Savage Landors Imaginary Conversations very poor
Sir J. Browne's Religio Medici
Lyell Book III there are many marginal notes
Rengger & Mitchell's Australia
Walter Scotts Life 1st 2nd & 7th volumes
Abercrombie on the Intellectual Powers.
Hunters Universal Oeconomy edited by Owen. read several papers all that bear on any of my subjects
Elie de Beaumont 10 vols of Memoires on Geology of France on Etna almost re-read the previous volume & C. Prevost on l'Ile Julie
Waterton's Essays on Natural History Octob 2d [1838]
Transactions of Royal Irish Academy ditto
Lavater's Physiognomy Octob 3rd
Malthus on Population
W. Earl's Eastern Seas. Octob 12th |
271–274 *excised* :
275 Sir J. Sebright's Pamphlets } not abstracted
Wilkinsons on cattle }
Scientific Memoirs published by Taylor
Magazine of Zoology & Botany & continuation
Annals of Natural History
Skimmed von Buch travels
Whites Natural History of Selbourne References at end
Dr Langs Australian tract, skimmed
Macleays Horae Entomologicae
Rays Wisdom of God references at end
The British Aviary — ditto
Lisle's Husbandry
Tuckey Voyage reread Appendix

Ovington Voyage to Surinam
Voyage Congo Expedition Zaire except Browns Appendix & excellent table of Canary Island plants
Home's History of Man
Transactions of the Entomological Society vol. I & 1st no. of vol. II (read remainder) when out |
276 Most of those which have references at end, is so said to have
Books examined with ref : to species
Mackenzie's Iceland
Molinas Chile
Falkner Patagonia
Azara Voyage & Quadrupeds of Paraguay
Dobrizhoffer Abipomnes
Edinburgh New Phil. Journal about 13 numbers have been read
Voyage a l'isle de France
{ Voyage de l'Astrolabe
{ Partie Zoologique
Pernety voyage a l'isle Malouines
Zoological Journal 5 vols
Voyage de la Coquille
Zoological Transactions up to parts published March 1838. done
Whole of Geographical Journal
Asiatic Journal to end of 1837, read. contains very little
Macleay's letter to Dr Fleming & Review of letter in Quarterly |

Inside Back Cover :

Read Volney's Travels in Syria vol 1, p 71. account of European plants transported —
Crawford. Eastern Archipelago probably some account
Raffles Sir S. ditto ditto —
Buffon suites
Line on the improvement of domesticated animals
Fries de plantarum praesertim crypt. transitu et analogior commentalia
Library of Useful Knowledge on horse & cow & sheep
Clarke's travels
Temmincks Hist. Nat. des Pigeons et des Gallinacés
Sillimans Journal during 1837. paper by Bachman on migration of birds [vol. 30 July 1836, p. 81.]
Temminck has written Coup d'Oeil sur la faune des iles de la sonde et de l'empire du Japon
Wowett on cattle — (Waterhouse has it)
Shells from Bernier Island many relations with a *living* Natica & many shells of genera Corbula, Chama, Cardium, Porcellana, Turbo, Cerithium
Jardin du Roi
Java fossils at same time
Study Botanical works on Buds & Gemmae

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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES PART III

Edited with an Introduction and Notes by
SIR GAVIN DE BEER

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL Vol. 2 No. 4
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Pp. 119–150

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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by

Sir GAVIN de BEER

Part III. Third Notebook (July 15th to October 2nd 1838)

INTRODUCTION

Darwin began his Third Notebook on Transmutation of Species on 15th July 1838 and finished it on 2nd October of the same year. From the list of books read, appended to the Second Notebook, it is known that he did not read Malthus's Essay on Population before 3rd October 1838, from which it can be seen that the contents of the Third Notebook owe nothing to Malthus's work. It is therefore of great importance to note that Darwin hit on the principle of natural selection independently. After a consideration of changes resulting in the formation of new species, he wrote :—" All this agrees well with my view of those forms slightly favoured getting the upper hand and forming species " (III 175).[1] Darwin himself realized the historical importance of these lines, because at a later date, probably 14th December 1856 when he looked through his Notebook, he wrote at the head of it : " Towards close I first thought of selection owing to struggle ".

It has always been a puzzle to know why the stimulus of Malthus's book should have been necessary to put Darwin on the scent of natural selection about which Malthus knew nothing, and Darwin's Third Notebook now shows that the problem has hitherto been incorrectly formulated. From the various passages in the extant portions of the first three Notebooks it is clear that Darwin had independently grasped two ideas. One was the parallel between the effects of artificial selection by man and those of natural selection. It is contained in the Third Notebook and supported by the observation that the magnitude of the differences between domestic breeds of cattle exemplified in the hump of Indian cattle is comparable to that of the differences between the species of cattle and of bison (III 65).

The second idea was that of forms slightly favoured getting the upper hand and forming species. But it was an idea of natural selection without stress on the heavy and unavoidable penalties for failure in the struggle for existence, although the probability of extinction as the price to be paid for insufficient adaptation was already recognized in the First Notebook (I 38). It seems that it was the mathematical demonstration of the insufficiency of food supplies if numbers increased too fast, and the consequent inevitableness of the penalties, that Darwin derived from Malthus's work, not the principle of selection itself which completely undermines the validity of Malthus's own thesis that mankind was unimprovable.

[1] References are made to the Notebook on Transmutation of Species concerned in Roman figures, and to the MS. pages in Arabic figures.

The proof of the correctness of this interpretation of the story is to be found in the letter[1] which Darwin wrote to Wallace on 6th April 1859, in which he explained that after reading Malthus's book he " saw at once how to apply the principle of natural selection ". He had already grasped the principle of natural selection and had seen how it could result in unlimited change away from the ancestral type and the production of new species ; but he had not recognized how nature enforced it until he read Malthus.

The Third Notebook contains a number of passages which reveal Darwin's outlook on his own work and that of his predecessors. The most important is the following :— " Seeing what von Buch, Humboldt, G. St. Hilaire & Lamarck have written I pretend to no originality of idea (though I arrived at them quite independently & have used them since) the line of proof and reducing facts to law only merit if merit there be in following work." (III 69). These words come early in the Third Notebook and refer to the period *before* his discovery of the principle of natural selection. They are in complete agreement with what Darwin wrote[2] to Baden Powell twenty eight years later, after the publication of the *Origin of Species* :—" No educated person, not even the most ignorant, could suppose that I meant to arrogate to myself the origination of the doctrine that species had not been independently created. The only novelty in my work is the attempt to explain *how* species became modified, & to a certain extent how the theory of descent explains certain large classes of facts ; & in these respects I have received no assistance from my predecessors."

After the *Origin of Species* was published, Darwin wrote[3] to F. W. Hutton, 20th April 1861 :—" I am actually weary of telling people that I do not pretend to adduce direct evidence of one species changing into another, but that I believe that this view is in the main correct, because so many phenomena can be thus grouped together and explained. . . . I generally throw in their teeth the universally admitted theory of the undulations of light . . . admitted because the view explains so much."

The stress on the value of his theory in explaining the " large classes of facts " is already made in the Third Notebook :—" In comparing my theory with any other, it should be observed not what comparative difficulties (as long as not overwhelming) [but] what comparative solutions and linking of facts " (III 71).

The Third Notebook also contains some interesting remarks on Darwin's methods. " Although no new fact be elicited by these speculations even if partly true they are of the greatest service towards the end of science, namely prediction, till facts are grouped & called there can be no prediction. The only advantage of discovering laws is to foretell what will happen & to see bearing of scattered facts." (III 67).

Much ink has been used to argue the question whether Darwin arrived at his conclusions as a result of inductive processes of reasoning. Writing at a time when so-called Baconian principles of induction were widely thought to be the only " correct " method of scientific inquiry, Adam Sedgwick[4] accused Darwin of deserting

[1] *More Letters of Charles Darwin*, edited by F. Darwin and A. C. Seward, London 1903, vol. 1, p. 118.
[2] Sir Gavin de Beer. " Some unpublished letters of Charles Darwin ", *Notes and Records of the Royal Society of London*, 1959, vol. 14, pp. 12–66.
[3] *M. L.*, vol. 1, pp. 183, 184.
[4] *Life and Letters of Charles Darwin* edited by Francis Darwin, London 1887, vol. 2, pp. 247–250.

these principles and used this argument for the express purpose of discrediting the theory of evolution by natural selection. Other critics, more recent, have accepted Darwin's conclusions but claimed that he was mistaken in thinking that he had arrived at them inductively and even reproached him for " speculating " in his Notebooks, as if it was reprehensible. Darwin himself always maintained that he had used induction and wrote[1] in his Autobiography that he " worked on the true Baconian principles, and without any theory collected facts on a wholesale scale ". This did not mean that he must refrain from basing a hypothesis on each fact as he came to it, if he could. In the Notebooks he explained his method of working quite clearly : " The line of argument often pursued throughout my theory is to establish a point as a probability by induction & to apply it as hypotheses to other points & see whether it will solve them " (III 117). This is precisely what the Notebooks show. An authority is quoted for some observation believed to establish a fact, and immediately Darwin began asking questions suggested by the fact to see if a hypothesis constructed *ad hoc* was applicable to other situations. The Notebooks are littered with these queries.

Later in his life, in a letter[2] to Sir John Fiske dated 8th December 1874, Darwin described his method more explicitly but less correctly : " my mind is so fixed by the inductive method, that I cannot appreciate deductive reasoning. I must begin with a good body of facts and not from principle (in which I always suspect a fallacy), and then as much deduction as you please." In place of " deduction " he should have said " hypothesis and deduction ". The hypotheses and deductions can follow immediately from each fact.

The facts and the tentative hypotheses based on them follow one another pell mell through the Notebooks, and the attempts to reprove Darwin for speculating in his Notebooks are futile. He was seldom more than one jump ahead of his facts, and it was precisely because he was one jump ahead that he made progress. As Darwin wrote[3] to Lyell, 1st June 1860, referring to a paper by Hopkins who refused to accept the explanatory value of a theory as evidence of its correctness : " on his standard of proof, natural science would never progress, for without the making of theories, I am convinced there would be no observations ". In a letter to Henry Fawcett, 18th September 1861 Darwin wrote :[4]—" About 30 years ago there was much talk that geologists ought only to observe and not theorise ; and I well remember some one saying that at this rate a man might as well go into a gravel pit and count the pebbles and describe the colours ". When Darwin was speculating without a firm basis of fact he was careful to warn himself : " *Pure hypothesis* be careful " (III 58).

In a masterly study of the problem, Alvar Ellegård[5] has shown that the method of hypothesis by means of which Darwin worked was perfectly legitimate. As early as 1860 T. H. Huxley had pointed this out :[6] " There cannot be a doubt that the

[1] *Autobiography of Charles Darwin* edited by Nora Barlow, London 1958, p. 119.
[2] *L. & L.*, vol. 3, p. 193.
[3] *L. & L.*, vol. 2, p. 315.
[4] *M. L.*, vol. 1, p. 195.
[5] Alvar Ellegård. " The Darwinian Theory and Nineteenth-Century Philosophies of Science ", *Journ. History of Ideas*, 1957, vol. 18, pp. 362–393.
[6] T. H. Huxley. *Westminster Review*, 1860, vol. 17, p. 566.

method of inquiry which Mr. Darwin has adopted is not only rigorously in accordance with the canons of scientific logic, but that it is the only adequate method ". Huxley also had a rod in pickle[1] for the philosophers of science who cavilled at Darwin's method in order to try to invalidate his results :—" Critics exclusively trained in classics or in mathematics, who have never determined a scientific fact in their lives by induction from experiment or observation, prate learnedly about Mr. Darwin's method, which is not inductive enough, not Baconian enough, forsooth, for them. But even if partial acquaintance with the process of scientific investigation is denied to them, they may learn, by the perusal of Mr. Mill's admirable chapter " On the Deductive Method ", that there are multitudes of scientific inquiries in which the method of pure induction helps the investigator but a very little way ".

The attempts by Darwin's opponents to discredit his views by appealing to " Baconian principles of induction " as the only true path of science are particularly disingenuous. As Stanley Jevons[2] showed many years ago, not only are the processes of inductive and deductive reasoning inseparable in the construction of theories capable of generalisation, but they *must* be accompanied by hypothesis ; and in any case it is incorrect to ascribe the principle of inductive reasoning in scientific method to Francis Bacon. Darwin was abundantly justified in his procedure " of inventing a theory and seeing how many classes of facts the theory would explain."[3] The Notebooks show that he had already realized the importance and value of this method.

An hypothesis is an idea based by induction on facts, in an attempt to find a consistent formula to fit other facts. Furthermore, as James K. Feibleman[4] has stressed, " an induction to an hypothesis is just what it is quite independently of whether it was suggested by one fact or a thousand ; the hypothesis itself is what is important, and depends for its staying powers upon its truth or falsity ".

In Darwin's case the first three facts from which he started are known.[5] They were the discovery by him of " great fossil animals covered with armour like that on the existing armadillos ", " the manner in which closely allied animals replace one another in proceeding southwards over the Continent ", " the South American character of most of the productions of the Galapagos archipelago, and . . . the manner in which they differ slightly on each island of the group ". Darwin's observations and reflections on the conditions which he found in the Galapagos Islands led to his now famous entry in his Ornithological Notebook :[6]—" When I recollect the fact, that from the form of the body, shape of the scale and general size, the Spaniards can at once pronounce from which Isd. any tortoise may have been brought :— when I see these islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds but slightly differing in structure and filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware is the constant asserted difference between the

[1] T. H. Huxley. *Lectures and Essays*, London 1908, p. 172.
[2] W. Stanley Jevons. *Logic*, London 1889, p. 79.
[3] *L. & L.*, vol. 2, p. 241.
[4] J. K. Feibleman. " Darwin and Scientific Method ", *Tulane Studies in Philosophy*, 1959, vol. 8, p. 8.
[5] *Autob.*, p. 118.
[6] *Charles Darwin and the Voyage of the Beagle* edited by Nora Barlow, London 1945, p. 246.

wolf-like Fox of East and West Falkland Islands. If there is the slightest foundation for these remarks, the Zoology of Archipelagoes will be well worth examining; for such facts would undermine the stability of species."

The problem presented to Darwin did not admit of many degrees of freedom in its solution. If the various species had not all been specially created with the observed differences between them ready-made, then they must have been produced by descent with modification from their ancestors. But this was the idea which had been put forward by Erasmus Darwin and Lamarck, extolled by Grant, condemned by Lyell, and hitherto rejected by Darwin. As Darwin explained, he independently arrived at the same idea as a hypothesis, and the First Notebook on Transmutation of Species[1] contains Darwin's earliest known formulation of that hypothesis and search for facts wherewith to test it.

The first 54 pages of the First Notebook are devoted to a straightforward exposition of the reasons which led Darwin to abandon the view of the immutability of species and to accept the hypothesis of transmutation or evolution. It is noteworthy that the three facts which started Darwin on his train of thought do not figure in this exposition, and this is a measure of the amount of consideration which Darwin had given to the problem between the time when he was in the *Beagle* and July 1837 when he opened his First Notebook on Transmutation of Species.

As the problem was one of differences between species, the first step in the analysis was the question of the origin of differences or variation. Here he found Erasmus Darwin's statement of empirical fact that variation was the natural result of sexual reproduction. But if variation occurs, deductive reasoning leads to the conclusion that species ought not to remain constant. Why, then, do species remain as constant as they do? Hypothesis: interbreeding within the whole population quashes variation of the species away from the type. This was the nearest approach to empirical fact that the then-prevailing total ignorance of the processes of genetics allowed him to make. If interbreeding within the whole population quashes variation, then what will happen if a portion of a population is prevented from interbreeding with the remainder by geographical isolation? Hypothesis: the portion of the population will vary, form a variety, and ultimately a new species. If this be so, then by deduction it ought to be observable that in some isolated regions this has happened. It is: the inhabitants of isolated areas such as the Galapagos Islands, Falkland Islands, Ireland, etc. show forms which are permanent varieties or different species as compared with the inhabitants of neighbouring lands.

If species are formed in this way from pre-existing species, there must be divergence in the lines of descent; but the number of different species living together in one region cannot be unlimited: therefore hypothesis: some species should die out. They have done so; extinction is a fact. Now if species are related to one another by common descent and some of them have gone extinct, hypothesis: there ought to be differences between the magnitudes of difference between the different species. There are: species are grouped in different ways, some close together belonging to the same genus, others wide apart belonging to different genera.

[1] *Bull. Brit. Mus.* (*Nat. Hist.*) Historical Series, 1960, vol. 2, pp. 23–73.

In this manner by a sequence of observation of empirical facts, induction into hypothesis, deduction, and exposure to test by a search for new facts leading to refutation or confirmation of his hypothesis, Darwin gradually acquired confidence. His hypothesis became " my theory " and he foretold the results of its establishment : a common ancestor for man and all animals, netted together by affinity (I 232).

In all this argument so far, there is no explanation how species are caused to become modified, if they are. In the First three Notebooks up to nearly the end of the Third, about 1st October 1838, Darwin was in the stage described in the *Autobiography* :[1] " it was equally evident that neither the action of the surrounding conditions, nor the will of the organisms (especially in the case of plants) could account for the innumerable cases in which organisms of every kind are beautifully adapted to their habits of life, . . . and until these could be explained it seemed to me almost useless to endeavour to prove by indirect evidence, that species have been modified."

The idea of natural selection, so far as can be seen from the extant portions of the Notebooks, seems to have occurred to Darwin as a combination of the effects on him of the facts of variation, adaptation, and extinction. Variation must result in some forms being slightly more and others slightly less favoured. If this is so, hypothesis : " of those forms slightly favoured getting the upper hand & forming species " (III 175).

Once he was in the possession of the key of natural selection, Darwin worked by a combination of induction and deduction to construct the full theory of evolution by natural selection, as Sir Julian Huxley[2] and I[3] have shown. But this belongs to a stage in the development of Darwin's thought later than is represented by the first three Notebooks on Transmutation of Species, and is found in the Fourth Notebook, the Sketch of 1842, and the Essay of 1844.

The remainder of the Third Notebook is largely taken up with the search for facts at a time when they were lamentably few. Even the facts of fertilisation[4] were unknown, to say nothing of genetics. In trying to acquire the elements of zoology, botany, and physiology when there were no text-books, Darwin scoured whatever he could find and was led astray as often as not. With the hindsight of a hundred and twenty years of progress of knowledge in biology, there is something rather pathetic in the spectacle of Darwin wrestling with the problem of dominance of characters of different domestic breeds when crossed (III 3, 13, 42) and the hypothesis that dominance was determined by the relative ages of the breeds (III 16, 17, 43, 49, 108) ; with the relative importance of paternal and maternal influence on offspring (III 8, 44) ; with the explanation of the sterility of hybrids (III 15, 19) and with the possibility of telegony (III 8, 172).

[1] *Autob.*, p. 119.
[2] Sir Julian Huxley. *The Living Thoughts of Darwin*, London 1958, p. 12.
[3] Sir Gavin de Beer. " The Darwin-Wallace Centenary ", *Endeavour*, 1958, vol. 17, p. 65.
[4] Although sperms were first discovered in 1677 by Hamm, and Spallanzani's experiments proved that sperms and not the liquid in which they swam are the element responsible for fertilization, the penetration of an egg by a sperm was first observed by G. Newport in the frog's egg in 1854, and by N. Pringsheim in 1855 in an alga. It was not until 1875 that Oskar Hertwig discovered in the sea urchin that after fertilization one of the pronuclei contained in the egg is derived from the egg and the other from the sperm.

All the more remarkable, therefore, are the sound conclusions that he was sometimes able to draw :—*Regeneration :* " each part of animal must have structure of whole comprehended in itself " (III 130, 167) ; *degeneration :* " as Larva may be more perfect . . . than [adult] parent, so may species retrograde " (III 57) ; *adaptation :* " if animals became adapted to every minute change, they would not be fitted to the slow great changes really in progress " (III 167) ; *instinct :* " the simplest transmission is direct instinct & afterwards enlarged powers to meet with contingency " (III 118) ; *man :* " comparison of man with expression of monkey when offended, who loves who fears who is curious " (III 22), and the similarity of the sexual impulse in female animals and in women (III 99, 139).

Almost prophetic is Darwin's search for material on which to carry out researches in experimental embryology : " cannot I find some animal with definite *life* and split it, and see whether it retains same length of life " (III 165). It was nearly a century before Driesch and Spemann showed how this could be done.

There is something scientifically heroic in Darwin's wondering whether a man's amputated arm could not regenerate a man, if it could be kept alive in a form of tissue-culture (III 131).

As in the other Notebooks a number of pages were cut out of the Third by Darwin in 1856. Seventy two pages of it have been lost out of one hundred and eighty, but it is a matter for congratulation that the extant pages contain as much of importance as they do.

Darwin's Third Notebook on Transmutation of Species, also known as Notebook " D ", is Darwin MS 123 in the Cambridge University Library, to the authorities of which acknowledgement is warmly made for their unfailing assistance and courtesy, as also to Dr Sydney Smith and Mr. P. J. Gautrey for their kind and valuable help with the decipherment of some obscure passages.

Inside Front Cover

Charles Darwin 36 Great Marlborough Street 1838.

Did[1] Eyton's[2] hybrids when interbred show any tendency to return to either parent ? Is the first cross which makes hybrids productive like geese ? — Are the number of kittens between Lion & Tiger at litter as numerous as in common lion? Are the number of nipples in domesticated very fertile animals increased ? Where offspring heterogeneous in plants are the number of seeds greater ? — Mem. for Eyton. — Sir R. Heron's[3] case of breed of pigs with solid feet. —

(In this Book some curious note on monkeys recognizing sexes of animals.[4])

(All selected Dec. 14 — 1856)

Towards close I first thought of selection owing to struggle |

1 July 15th 1838 Finished October 2d.

As a proof what unknown causes act upon people my father[5] mention that for ten years, he never saw one case of malignant erysipelas spreading over the head, not caused by a wound, when suddenly during one time he had three patients at very distant quarters of the county, who had had no sort of communication, were seized with it, & for ten years afterwards, he then did not see other cases. — He 2 thinks Apoplexy affects people all over England at same periods. | When he began practice, he remember during a year or two he saw many cases of virulent cancer in women, & since that time it has been rare disease, but now (July 1838) he has seen more cases in a month, than in several previous years, two having consulted him on one day. — |

3 Mark[6] at Shrewsbury thinks the half bred Alderney cows take more after Alderney than the Durham, with which they have been crossed — is Alderney oldest breed — He believes all pretty much alike. — My Fathers Water in the brain[7] a century since used to be called Worm Fever, as used much more lately diseased mesatine glands. — My Father has seen case of pleurisy, broken limb in children & other such disorders accompanied with some fever, be attended by the transmission of 4 large number of worms | the child not having passed them before. Hence disordered intestines are not healthy to worms, (like parasites of Tropical countries cannot endure this climate). —

July 23rd. Eyton,[8] a stone blind horse, seemed to perceive turn on road where no houses to Caton Muscote, where he had been accustomed to turn down, — applicable to birds migrations & mistakes in Savages. |

5–7 *excised.*

8 [*sic*] When two dogs line the same bitch & perfect spaniels & setters are produced one would argue the whole effect of race was determined by male : & How completely is Lord Moreton's[9] case opposed to this fact & views.

[1] The remaining words on this cover inserted at a later date.
[2] Thomas Campbell Eyton.
[3] Sir Robert Heron. cf. *Variation of Animals and Plants under Domestication*, London 1868, vol. 2, p. 92. Footnote :—" Extract of a letter from Sir R. Heron, 1838 given me by Mr. Yarrell ".
[4] This and the following two sentences, inserted in pencil at a later date.
[5] Robert Waring Darwin.
[6] Mark, Dr Darwin's coachman at Shrewsbury. cf. *Emma Darwin*, Cambridge 1904, vol. 2, p. 13.
[7] " Water in the brain " appears to have been Dr. Darwin's term for this disorder.
[8] Thomas Campbell Eyton. Probably personal communication.
[9] Lord Morton. " A Communication of a singular fact in Natural History ", (read November 1820) *Phil. Trans. Roy. Soc.*, 1821, vol. cxi, p. 20.

Fox[1] says a cousin, one of Mr. Strutt of his used to breed to common & Muscovy Ducks. — English, China & Canada Geese, & that this first cross were *equally* fertile with pure bred animals. — Mem. number of mules. — He recollects one hatch of
10 hybrid geese very fine. — How is it | with plants? This indicates a remarkable law, that first cross plentiful, second absolutely sterile. —

My case of stallion, according to Erasmus[2] preferring young mare to old, explained by stallion (according to Fox) being guided entirely by their smell.

Fox[3] says he knew a carter well who placed his stallion as second horse between shaft mares |

11–12 *excised.*

13 Fox[4] says where common & China geese are crossed the neck is not intermediate in its peculiar long neck, but much nearer to common goose. —

What has long been in blood, will remain in blood, — converse, what has not been, will not remain, — yet offspring must be somewhat like parents, — therefore offspring will tend to go back, or have none, — this argument does not apply to first
14 parents, because they are not new breed. — the first hybrids may be | compared to animal with amputated limb. Hereditary six-fingered people, Lord Renwick[?] family with defective palates, hereditary & therefore exceptions to above law. — Study what these monsters are: — are they abortive twins. — The fertility of first cross, as stated by Fox, is very important, as showing above facts as first cross being new species. —

15 Are not dreadful monsters abortive, just like *mules.* | Fox's[5] half bred Persian cats favour the Persian side. — Theory of abortive hybrids. — If mules did breed the offspring would as in all other animals be like either parent or intermediate within certain small limits (within which limits they might return to either parent). Then according [to] law, that in proportion as things are long in blood so will they remain, a mule being new species will have every tendency to have offspring like parent, but as they must [be] like or there will be none, therefore a mule can have no offspring. — But as badly deformed people & as mutilations (produced very quickly) sometimes have similar offsprings, so will the worst mules (as real mule) have offspring. — Slight deformities as supernumerary fingers (that is slight alteration of primitive stocks related to changes which every species undergoes) & hybrids between very near *species* (that is slight alterations of primitive stock) are hereditary: Hybrids & Varieties is different because not long in blood. —

16 The case of union of perfect animals is | distinct case, — gradation from physical impossibility to (*perhaps increased*) fertility — (but many animals are fertile, — when offspring infertile, — two considerations are here combined.). In last page, we have seen [that] mules could have no offspring, & this being [the] case, owing to the corelations of system, the organ of generation would necessarily fail. — In last page, I should have said, " an animal is able to transmit only those peculiarities
17 to its offspring, which have been *gained slowly*, now all the mules | have their whole

[1] William Darwin Fox. Darwin's second cousin.
[2] Presumably Erasmus Alvey Darwin, Darwin's elder brother.
[3] William Darwin Fox. Personal communication.
[4] *Idem.*
[5] *Idem.*

form of body gained in one generation, so it is impossible to transmit them, & as offspring must be like parent, therefore mule has no offspring & therefore no generative organ.

Same Prop. better enunciated. — An animal in either parent cannot transmit to its offspring any change from the form which it inherits from its parents stock without it be small & slowly attained. N.B. The longer a thing is in the blood the more persistent any amount of change & shorter time less so. The result of this is that animal would endeavour to return to parent stock, but if both parents are alike, offspring must be like. |

18 Hence mutilations not hereditary, but size of particular muscles. — When two animals cross, each sends his own likeness & the union makes hybrid, in fact the parents beget child like themselves. expression of countenances, organic diseases, mental disposition, stature, are slowly obtained & hereditary; if the change be congenital (that is most slowly obtained with respect to that individual) it is more easily inherited, — but if change be in blood long, it becomes part of [the] animal, — by a succession of generations, these small changes become multiplied, & great
19 change be effected, but | in a mule these conditions are not fullfilled. My grandfathers[1] theory of mules not hereditary, because generation highest point of organization, false. — The creator would thus contradict his own law. So far is there any appearance of animals being created, it is probable if created at once, according to ordinary laws, the character of offspring would vary, or rather they would not have offspring. —

On the idea of generation being a bud from parent, if whole parent not entirely imbued with the change, a bud could not be taken, without it either went back, or not being perfect would perish. — |

20 The varieties of the domesticated animals must be most complicated, because they are partly local & then the local ones are taken to fresh country & breed confined to certain best individuals. — scarcely any breed but what some individuals are picked out, — in a really natural breed, not one is picked out, & few even of local varieties approaches quite to wild local variety. our European varieties must be very unnatural. — Italian Greyhound is probably the effect of local variety many times
21 changed | together with some training in the earlier branches as in common greyhound & much intermarriage. —

In my speculations, must not go back to first stock of all animals, but merely to classes where types exist, for if so, it will be necessary to show how the first eye is formed, — how one nerve becomes sensitive to light, (Mem. whole plant may be considered as one large eye — have they smell, do plants emit odour solely for other parts of creation) & another nerve to finest vibration of sound, which is impossible. — |

22 Mr Spence[2] remarks that the Fringilla domestica of North Europe is replaced by

[1] Erasmus Darwin. *Zoonomia*, London 1794, vol. 1, p. 513 :—" mules which evidently partake of both parents, but principally of the male parent ".

[2] William B. Spence. " Observations on a mode practised in Italy of excluding the Common House-fly from Apartments ", *Trans. Entom. Soc. Lond.*, 1836, vol. 1, p. 1. On p. 6 :—" it would also be desirable to have similar experiments made as to the house-flies of America and other hot countries, in which it is probable that in the same way as our common sparrow (*Fringilla domestica*, Linn.) is replaced in Italy by another species (*F. cisalpina*, Temm.), which to an ordinary observer seems identical with ours, but is really distinct, . . . "

the F. cisalpina in Italy which is so like that difference would not be discovered by an unscientific observer. — Transactions of the Entomological Soc.

A capital passage might be made from comparison of man, with expression of monkey when offended, who loves who fears who is curious &c. &c. &c. who imitates. — who will say there is distinct creation required if he believe Hyaena & squirrel seal & mouse elephant, come from one stock. — |

23 *Theory of Geograph. Distrib.: of organic beings.* —

Animals of same classes differ in different countries in exact proportion to the time they have been separated; together with physical differences of country: the time of separation depends on facility of transport in the species itself, & in the local circumstances of the two countries in times present & past. The effect of physical conditions of country is not perhaps so great, as separation or interbreeding, for

24 otherwise we could not understand the vast number | of domesticated races. —

Athenaeum, [1] p. 505, some (very poor account) of plants of Nova Zemblia in review of Baers work.

Edinburgh Royal Transact.[2] — p. 297, vol. 9, Dr Ferguson seems most clear that the ideosyncrasy of the Negro (& partly mulatto) prevents his taking any form of Malaria — Adaptation & species-like. — Says Negro thick skinned.

My hairdresser (Willis)[3] says that strength of hair goes with colour, black being strongest. |

25 V p. 63. Note Book *M*[1] for case of change in food in insects entered by mistake.[4] Surely the fossil Mammalogy of Britain & Europe is African, & the only difference is by the *extinction* of certain forms from northern part & not by fresh creation of new forms. — What is range of Hyaena? Hippopotamus? Indio-African, or Pure Africa? — Fossil Elephant of Africa most important under this view, & Hippo[po]tamus of Madagascar: because contemporaries.

In introduction to Eytons[5] Anatidae — recurs to idea of only animals from distant countries breeding! mem. 3 species of goose Has not goldfinch & greenfinch bred, & surely wild duck & pintail & widgeon! — Divides world into zoological Provinces, animals according to varieties of man. ?Will it hold good. —Thinks Temminck[6] doubtful when he says no genera. — In Australia plants E & W very different, — man not so but N. & S. New Zealand, New Caledonia two races of man

26 but not plants. thinks | there are some small divisions. — does not seem to think

[1] Karl Ernst von Baer. Review of "Expedition to Novaia Zemlia and Lapland" (St. Petersbourgh Bull Sci., III, 1838), *Athenaeum*, 1838, July 21, p. 505.

[2] William Ferguson. "On the Nature and History of the Marsh Poison", *Trans. Roy. Soc. Edinb.*, (read Jan. 3, 1820) 1823, vol. 9, p. 273. On p. 297 there is a note "On the Negro Skin": " . . . From peculiarity of idiosyncrasy, he appears to be proof against endemic fevers; . . . One of the most obvious peculiarities of the Negro, compared with the European, is the texture of his skin, which is thick, oily . . . " *cf.* recent research on the immunity against malaria conferred by sickle trait, A. C. Allison: "Human Haemoglobin types", *New Biology*, 21, 1956, p. 43. (Penguin Books).

[3] Mr. Willis. Hairdresser. cf. below MS. p. 163.

[4] The reference is to Darwin's First Notebook on Metaphysics, Morals & Speculations on Expression (Cambridge University Library, Darwin MS. 125) begun 15th July 1838, finished 2nd October 1838, from which p. 63 was excised by Darwin on 16th December 1856.

[5] Thomas Campbell Eyton. *A Monograph on the Anatidae*, London, 1838, p. 1:—" . . . that those animals upon which this experiment has been tried have invariably been brought from countries far apart, . . . "

[6] Coenraad Jacob Temminck. Presumably *Observations sur la classification méthodique des oiseaux*, Amsterdam & Paris 1817.

any improbability to animals being distributed after *flood* (!) according to affinities! confounds, *like Whewell*,[1] affinity with analogy. — Good table at end of distrib.: of Anatidae. — Consult this book again. —

Mine is a bold theory, which attemps to explain, or asserts to be explicable every instinct in animals.

Heard at Zoolog. Soc. that Pintail & Common Ducks, breed one with another — & hybrids fertile inter se (No) directly against Eyton's rule.[2] ?Are the hybrids similar inter se — |

27–34 *excised.*

35 Owen[3] says relation of Osteology of birds to Reptiles shown in osteology of young Ostrich.

16th [Aug.] D Israeli[4] (Cur. of Literat. vol. II, p. 11) accidentally says " — is distinctly marked as whole dynasties have been featured by the Austrian lip & the Bourbon nose ", if this be not imagination, then old peculiarity overbears the crossing with females not thus characterized. — |

36 16th Aug. What a magnificent view one can take of the world Astronomical causes modified by unknown ones, cause changes in geography & changes of climate suspended to change of climate from physical causes, — then suspended changes of form in the organic world, as adaptation, & these changing affect each other, & their bodies by certain laws of harmony keep perfect in these themselves. — instincts alter, reason is formed & the world peopled with myriads of distinct forms from a period short of eternity to the present time, to the future. — How far grander than

37 idea from cramped | imagination that God created (warring against those very laws he established in all organic nature) the Rhinoceros of Java & Sumatra,[5] that since the time of the Silurian he has made a long succession of vile molluscous animals. How beneath the dignity of him, who is supposed to have said let there be light & there was light. — whom it has been declared " he said let there be light & there was light " — bad taste.

August 19th Two regions may be Zool.-geographically divided either by developement of new forms in one, or apparently so by the extinction of prominent ones in one: The latter will take place when conditions are unfavourable to numbers of

38 animals as in changing from warm to | cold, damp to dry. — Thus Tierra del Fuego has only one Guanaco of this characteristic form of S. America.

With respect to future destinies of mankind, some of [the] species or varieties are becoming extinct, others though the negro of Africa is not loosing ground, yet, as the tribes of the interior are pushing into each other from slave trade & colonization of S. Africa, so must the tribes become blended & prevent the strong separation

39 which | otherwise would have taken place otherwise in 10,000 years. Negro probably

[1] William Whewell, author of *History of the Inductive Sciences*, London 1837.

[2] Thomas Campbell Eyton. " Some remarks upon the theory of Hybridity ", *Mag. Nat. Hist.*, 1837, vol. 1, p. 357.

[3] Richard Owen. " On the anatomy of the Southern Apteryx (*Apteryx australis*, Shaw)." Communicated 10th April 1838. *Trans. Zool. Soc. Lond.*, vol. 2, 1836–1841, p. 257. On page 189 :—" The close resemblance of the Bird to the Reptile in its skeleton is well exemplified in the young Ostrich, . . . "

[4] Isaac Disraeli. *Curiosities of Literature.*

[5] cf. Darwin's *Sketch* of 1842 and his *Essay* of 1844 ; in *Evolution by Natural Selection* with a Foreword by Sir Gavin de Beer, Cambridge 1958, pp. 83 and 249.

a distinct species — We know how long a mammal may go on as one species from Egyptian mummies & from the existing animals found fossil when Europe must have worn a quite different figure.

19th [Aug.] With respect to the Deluge, it may be worth adding in note that amongst the Mammalia of Europe the shells of ditto — shells of N. America — shells of S. America, — there is no appearance of sudden termination of existence, — nor is there in the Tertiary geological epochs. — |

40 There are some admirable tables on geograph distribution of reptiles in Suites de Buffon.[1] —

Vigors[2] has given list in Linnean Transactions of birds of Java — Caterpillars not being fertile is same as children not being so. — consider this with reference to " new species & hybrid doctrine ". — I have read there are exceptions to this in some larvae of insects. (?glowworm) breeding — imago state fertile at once. — Consider this with reference to those insects which have fertile offspring. Entomostraca & Aphides. |

41 The extreme difference of sexes is probably arrived at wing case of insects as glowworm.

The case of one impregnation sufficing to several births analogous to superfoetation, & the successive fertile offspring in Entomostraca & Aphides. Developement of sexes in caterpillars, very valuable facts — they are eating foetuses, as young of Marsup. is sucking foetus. —

August 23rd The Rev. R. Jones[3] gave an admirable harrier from Ireland to Brighton
42 Pack — *first rate* bitch — tried to breed from her, but | her offspring came out one big & one small. Now Jones, before this happened from her looks thought she was half bred Beagle & Staghound. the grandchildren went back to either parent & breed not fixed, though she resembled a harrier & her husband was pure harrier.

Three gentlemen of parts all thought with pigs &c, that hybrids were uncertain. The peculiarities of our breeds must have been acquired, & hence this is true case of avitism.

Mr Drinkwater[4] thought that a " first blood " animal must have gone on for many years, before deserves to be so called, — the short horned cattle have gone on for
43 50 or 70? years, — now well fixed breed : Jones[5] says Sussex cattle | were all white headed, but this was bred out & now all are pure red, yet calf every now & then born with white head (or short-horned with black lip) & then calf in both cases is killed.

Notes from *Glen Roy* Note Book.[6]

Why is not Tetrao Scoticus an American form (if so)?. —

F. M. Daudin. *Histoire naturelle, générale et particulière des reptiles ; ouvrage faisant suite aux Oeuvres de Leclerc de Buffon.* Paris an XII [1805].

[2] Nicolas Aylward Vigors [& Thomas Horsfield.] " A description of the Australian birds in the collection of the Linnean Society ; with an Attempt at arranging them according to their natural Affinities." *Trans. Linn. Soc. Lond.* vol. 15 Part 2, 1837, p. 170. This paper contains no list of Javanese birds, but on p. 331 there is a statement that " These two species very closely accord with the Javanese species of *Pomatorhinus, P. montanus,* described in these Transactions."

[3] Rev. R. Jones. Unidentified.

[4] Drinkwater. Unidentified.

[5] Rev. R. Jones. *Idem.*

[6] Darwin visited Glen Roy at the end of June and beginning of July 1838. (" Darwin s Journal ", edited by Sir Gavin de Beer, *Brit. Mus. (Nat. Hist.)*, Historical Series, vol. 2, London 1959, p. 8.)

A Shepherd of Glen Tunet said he learnt to know lambs, because in their faces they were most like their mothers, believe this resemblance general. ?depend upon mother being oldest breed? —

Quarterly Journal of Agriculture[1] p. 367, Dec. 1837. *Generally* received. |

44 Opinion that male impresses offspring more than female, yet instances given on opposite side. —

The theory of males impressing most is in harmony with their wars & rivalry. — The very many breeds of animals in Britain shows, with the aid of *seclusion* in breeding how easy races or varieties are made. —

The Highland Shepherd dogs coloured like Magellanic Fox, — peculiar hair & appearance — good case of Provincial Breed — Highland Sheep jet black legs, & face & tail, just like spencer[2] [?] high active breeding |

45–48 *excised.*

49 L'Institut[3] p. 249 (1838). Eggs discovered to Taenia, — hard so as to resist external influence.

27th August. There must be some law that whatever organization an animal has, it tends to multiply & *improve* on it. — Articulate animals must articulate, & in vertebrate tendency to improve in intellect, — if generation is condensation of change, then animals must tend to improve. — Yet fish same as, or lower than in old days: for a very old variety will be harder to vary & therefore more apt to be extinguished. — ???

Mayo[4] (Philosoph. of Living) quotes Whewell[5] as profound because he says length of days adapted to duration of sleep of man!!! whole universe so adapted!!! & not man to Planets. — instance of arrogance!! |

50 August 29th. — Macleay[6] in A. Smith Zoolog. — of Africa. —

[1] *Quarterly Journal of Agriculture*, Edinburgh 1837, vol. 8, p. 367 :—" . . . According to the generally received opinion, that the male imprints his characters more indelibly than the female on the progeny, there may be a risk of breeding from too large a horse for the usual purposes of the farm; but, on the other hand, it is frequently seen that small stallions and bulls produce large stock. . . . " Probably by one of the editors.

[2] Lord Spencer. *Journ. Roy. Agr. Soc.*, vol. 1, p. 24 :—" It is therefore very desirable, before any man commences to breed either cattle or sheep, that he should make up his mind to the shape and qualities he wishes to obtain, and steadily pursue this object." cf. *Variation of Animals and Plants under Domestication*, London 1868, vol. 2, p. 195.

[3] Félix Dujardin. *L'Institut*, 1838, 2 août, p. 249 :—" . . . les oeufs de Taenia protégés par une coque très résistante peuvent résister aux causes extérieures de destruction . . . "

[4] Herbert Mayo. *The Philosophy of Living*, London 1838, p. 136, Chapter III, " Of Sleep ".

[5] William Whewell. " The Length of the Day ", *The Bridgewater Treatises on the Power Wisdom and Goodness of God as manifested in the Creation*, Treatise III, On Astronomy and General Physics, p. 38. On p. 39 :—" . . . Man, in like manner, in all nations and ages, takes his principal rest once in twenty-four hours; and the regularity of this practice seems most suitable to his health, though the duration of the time allotted to repose is extremely different in different cases. So far as we can judge, this period is of a length beneficial to the human frame, independent of the effect of external agents. In the voyages recently made into the high northern latitudes, where the sun did not rise for three months, the crews of ships were made to adhere, with the utmost punctuality to the habit of retiring to rest at nine, and rising a quarter before six; and they enjoyed, under circumstances apparently the most trying, a state of salubrity quite remarkable. This shows, that according to the common constitution of such men, the cycle of twenty-four hours is very commodious, though not imposed on them by external circumstances.

" The hours of food and repose are capable of such wide modifications in animals, and above all in man, by the influence of external stimulants and internal emotions, that it is not easy to distinguish what portion of the tendency to such alterations depends on original constitution. . . . "

[6] William Sharp Macleay. " Annulosa " in Andrew Smith : *Illustrations of the Zoology of South Africa*; . . . London, 1838.

p. 4. sticks[1] to genus or group of any kind not being perfect till circular.

p. 5 Most clearly shows[2] that genus expresses as now used almost any group. — all groups *natural* (p. 6) as expressing *natural* affinities. Macleays plan of arrangement depends on the organs judged to be of importance in inverse ratio to their variability. — (Now ceteris paribus these will be the oldest.) "The most important characters break down in certain species & become worthless[3]" — Mammalia Edentata. We do (p. 6) say[4] such is group because it has such characters of importance, " but we say such happens to be the character, of no matter of what importance, which prevails throughout the group & serves to insulate it ". — i.e. what characters |
51 chance to be hereditary whether important or not.

p. 7. " The natural arrangement of animals themselves is the question in point ".[5] Now what is *natural arrangement*, — affinities, what is that, amount of resemblance, — how can we estimate this amount, when no scale of value of difference is or can be settled. — I believe *affinity* may be taken literally, though how far we can ever discover the real relationship is doubtful, — not till much knowledge is elicited. — It will rest upon the discovery what characters *vary* most easily, — those which do not vary being foundation for chief divisions. —

p. 7. In some cases the circular arrangement from fewness of forms, cannot be discovered untill we descend to subgenera & families,[6] in the Cetoniadae, — when will Ornithorhynchus come in circle?!!! |

52 p. 8 — Anomalous structures, as in Hippo[po]tamus, solely owing to number of lost links, if all species know[n] they would be innumerable[7] — does not know any difference between *permanent variety* & *species* !![8] (given in note) — Macleay uses term *genus* when it is so many steps from a head as subkingdom — evidently artificial, as interlopement of marsupials will change all, — & so on no one will settle *number*

[1] *Ibid.* p. 4 ;—" Omnis sectio naturalis circulum, per se clausum exhibet."

[2] *Ibid.* p. 5 :—" . . . has the word *genus* any signification which is universally deemed definite? "

[3] *Ibid.* p. 6 :—" . . . the most important characters break down in certain species, and become at times perfectly worthless . . . "

[4] *Ibid.* pp. 6–7 :—" . . . We do not argue that such must be the groupe, because such and such are in our opinion, good and distinct characters ; but we say, such happens to be the character, of no matter what importance, which prevails throughout the groupe, and which serves in some degree to insulate it from other groupes. . . . "

[5] *Ibid.* p. 7 :—" . . . we ought not to forget that the true question under consideration is, the natural arrangement of the animals themselves ; . . . "

[6] *Ibid.* p. 7 :—" . . . for owing to the rarity of its species, the first circular grouping of the species *Cryptodinus*, for instance, is into sub-genera ; . . . "

[7] *Ibid.* p. 8 :—" Thus, when the naturalist talks of any anomalous structure, I understand merely that so many links, that is so many groupes, of the great plan of creation are wanting, . . . If I say that the *Hippopotamus* forms a stirps by itself, I only mean that it is the sole species of its stirps known ; and that, speaking theoretically, four families are wanting, . . . or rather twenty-four genera to connect it well with other tribes of Pachyderms . . . "

[8] *Ibid.* p. 8 footnote :—" Some persons have imagined that I only assign five species to the lowest groupe in nature ; but the above theory evidently proceeds on the assumption that if we knew *all* the species of the creation, their number would be infinite, or in other words, that they would pass into each other by infinitely small differences. This actually takes place sometimes in nature ; and as yet I do not know any good distinction between a species and what is called ' a permanent variety '." cf. William Herbert : *Amaryllidaceae*, London 1837, p. 29 :—" That in some genera intermediate diversities from different localities so confound the limits of species that it is waste of words to argue whether a plant is a species or a permanent local variety ; . . . "

of primary divisions. — Complains[1] (p. 53) of M. Edwardes[2] thinking any group good, though not circular, if characters can be established — clearly so. — N.B. — This paper worth referring to again. — According to my theory, every species in any subgenus will be descended from one stock, & that stock with other subgenera |
53–56 *excised.*
57 Foetus of man undergoes metamorphosis, heart altered & umbilical cord. — Broderip[3] alluded to Hunter's views[4] on this subject. — Monstrosities kind of determined by *age* of foetus. —

As Larva may be more perfect (as we use the word) than parent, so may species retrograde, but these facts are rare. —

2[d] Sept. Those animals which have many *abortive* organs might be expected to have larva more perfect — this is applicable to young of Cochineal ??. |
58 Is there some law in nature an animal may acquire organs, but lose them with more difficulty — contradicted by abortive organs but number of species with abortive organs of any *kind* few, — hence become *extinct*, & hence the *improvements* of every type of organization. Such law would explain every thing. — *Pure hypothesis* be careful. —

Argument for circularity of groups. When a group of species is made, father probably will be dead — hence there is no central radiating point, all united, (like an uncle must be granted unequal, because fossil) now what is group without centre
59 but circle, two or three | lines deep — with respect to Macleay's[5] theory of analogies — when it is considered the tree of life must be erect not pressed on paper, to study the corresponding points.

The present geographical distribution of animals countenances the belief of their extreme antiquity (i.e. much intervening physical change) — distribution especially of Mammalia.

As every organ is modified by use, every *abortive* organ must have been once changed. — What is abortive? when it does not perform that function which *experience* shows us it was for. — Most important law. — Penguins wing perhaps not abortive ??? Apteryx certainly. — |
60 Lyell's[6] excellent view of geology of each formation being merely a page torn out of a history & the geologist being obliged to fill up the gaps, — is possibly the

[1] *Ibid.* p. 53 :—" M. Milne Edwards . . . produced a classification, of which I can only say, that it makes an approach to be a rare exception to the well-known fact, that professed comparative anatomists are the persons, of all others, who in general are most incapable of using their own observations for purposes of natural arrangement. And indeed this very arrangement of Edwards is not natural, since he unfortunately conceives that every groupe he can invent, provided he can furnish it with a character, must therefore be a good one."

[2] Henri Milne Edwards. *Histoire naturelle des Crustacés*, Paris 1834–40, vols. 3 & Atlas (forming one of Roret's " Collection des Suites à Buffon ").

[3] William John Broderip. Presumably personal communication.

[4] John Hunter in Richard Owen : *Descriptive and Illustrated Catalogue of the physiological series o, Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London 1833, vol. 1, p. iv, footnote : " I should imagine that monsters were formed monsters at the very first formation, for this reason, that all supernumerary parts are joined by their similar parts, viz. a head to a head &c. &c.' Hunterian MSS."

[5] William Sharp Macleay. *Horae Entomologicae*, London 1819–21, p. 391.

[6] Charles Lyell. *Elements of Geology*, London 1838, p. 272 :—" . . . of a series of sedimentary formations, they are like volumes of history, in which each writer has recorded the annals of his own times, and then laid down the book, with the last written page uppermost . . . "

same with the philospher who has traced the structure of animals & plants. — He get[s] merely a few pages.

Hence (p. 59) looking at animal, if there be many others somewhat allied whether like parent stock, or not, now wings for flight — therefore ostrich not. The peculiar Malacca bears belong to same section with those of India. |

61–64 *excised.*

65 man have carries the range — Argue the case of probability, has Creator made rat for Ascension — The Galapagos mouse probably transported like the New Zealand one — It should be observed with what facility mice attach themselves to man.

Sept 7th. I was struck looking at the Indian cattle with Bump, together with Bison of some resemblance as if the "*variation* in one was analogous to specific *character* of *other species* in *genus*". — Is there any law of this. Do any varieties

66 of sheep evidently artificial approach | in character to goats, — or dogs to foxes[1] (yes Australian dog) or donkeys to zebras. — Mr. Herberts variety of horse, dun coloured with stripe approaches to ass, or fowls to the several aboriginal species or ducks (here argue if it be said domestic fowls are descended from several stock[s] then species are fertile ; as long as opponents are[2] not able to tie themselves down, they can find loopholes) "It is well worthy of examination whether variations are produced only in those characters which are seen to be different in species of same genus".

67 Law of monstrosity not prospective, but retrospective in showing | what organs are little fixed — (Hunters[3] law of monstrosity with regard to age of foetus distinct consideration). Now in different *species* of genus Sus, see Cuvier[4] *Ossemens fossiles*, do vertebrae vary ? Although no new fact be elicited by these speculations even if partly true they are of the greatest service towards the end of science, namely prediction, till facts are grouped & called there can be no prediction. — The only advantage of discovering laws is to foretell what will happen & to see bearing of scattered facts. — |

68 What takes place in the formation of a bud — the very same must take place in copulation — (man & woman separate parts of same plant) — now in some Polypi we see young bud changing into ovules. —

Captain Grants[5] Himalaya shells (see Paper in Geolog Transact) same appearance with secondary species distinct but close. — Mem. Von Buch[6] on Cordillera fossils same remark. ? Was then formerly one great sea, & two Polar Continents. Marsupial, Edentata, Pachydermata &c. &c. — |

[1] William Herbert. *Amaryllidaceae*, London 1837. On p. 339 :—" . . . I have lately had under my observation a dog, whose father was a fox in an innyard at Ripon, and it has singularly the manner as well as the voice of a fox, but it is the parent of many families of puppies : and I feel satisfied that the fox and the dog are of one origin, and suspect the wolf and jackall to be of the same ; nor could I ever contemplate the black line down the back of a dun pony without entertaining a suspicion that the horse, unknown in a wild state except where it has escaped from domesticity, may be a magnificent improvement of the wild ass in the very earliest age of the world : . . . "

[2] Altered in MS. from "will not tie themselves down."

[3] John Hunter in Richard Owen : *Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London 1833, vol. 1, p. iv, footnote. See above, footnote to MS. p. 57.

[4] Georges Cuvier. *Recherches sur les Ossemens Fossiles des Quadrupèdes*, . . . Paris 1812.

[5] Captain C. W. Grant. Presumably "Memoirs to illustrate a geological map of Cutch", read 22nd February 1837, *Trans. Geol. Soc. Lond.*, 1840, vol. 4, p. 289.

[6] Leopold von Buch. "Ueber den zoologischen Charakter der Secundär-Formationen in Süd Amerika", *Monatssch. K. pr. Akad. Wissensch.*, Berlin, 1838, p. 54. (*Gesammelte Schriften*, Berlin 1885, Band 4, p. 497.

69 It is important with respect to extinction of species, the capability of only small amount of change at any one time.

Seeing what Von Buch[1] (Humboldt)[2] G. St. Hilaire,[3] & Lamarck[4] have written I pretend to no originality of idea — (though I arrived at them quite independently & have used them since) the line of proof & reducing facts to law only merit if merit there be in following work. —

The history of medicine, the extraordinary effects of different medium on organs leads one to suspect any amount of change from eating different kinds of food. Grazing animals which eat every species new. — |

70 Sept. 8th A Golden Pippin or Ribstone ditto producing occasionally (as Fox[5] says) same fruit trees is analogous to some hybrids breeding — there is tendency to reproduce in each case, but something prevents the completion. —

Say my grandfathers[6] expression of generat[ion] being highest end of organization *good expression* but does not include so many facts as mine. |

71 The facts about half bred animals being wilder than parents is very curious as pointing out difference between acquired & hereditary tameness. —

In comparing my theory with any other, it should be observed not what comparative difficulties (as long as not overwhelming) [but] what comparative solutions & linking of facts.

Savages over whole world (Major Mitchell[7] p. 244, vol. I) spit & throw dust. According to my theory of generation (p. 175) of[8] |

72 Yarrell[9] told me he had just heard of Black game & Ptarmigan having crossed in wild state — & the English & some African Dove. — The extinction of the S. American quadrupeds is difficulty on any theory — without God is supposed to create & destroy without rule. But what does he in this world without rule ? The destruction of the great Mammals over whole world shows there is rule. — S. America & Australia appear to have suffered most with respect to extinction of larger forms. —

From observing way the Marsupials of Australia have branched out into orders one is strongly tempted to believe one or two were landed |

73–74 *excised.*

[1] Leopold von Buch. *Description physique des iles Canaries*, Paris, 1836, p. 144. (cf. Darwin's First Notebook MS. p. 156) ; *Ibid.* p. 148, (cf. Darwin's First Notebook MS. p. 158).

[2] Friedrich Heinrich Alexander von Humboldt. *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, during the years* 1799–1804, London 1821, vol. 5, p. 565. (cf. Darwin's First Notebook MS. p. 142).

Ejusdem. *De Distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena*. Lutetiae Parisiorum 1817 (cf. Darwin's First Notebook MS. p. 156).

[3] Étienne Geoffroy-Saint-Hilaire. *Principes de philosophie zoologique*, Paris 1830. (cf. Darwin's First Notebook MS. *passim.*)

[4] Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809. *Histoire naturelle des animaux sans vertèbres*, 1815, Paris (cf. Darwin's First Notebook *passim.*).

Ejusdem. *Hydrogéologie, ou recherches sur l'influence génévale des eaux sur la surface du globe terrestre, sur les causes de l'existence du bassin des mers, de son déplacement, de son transport successif sur les différents points de ce globe, enfin sur les changements que les corps organisés vivants exercent sur la nature et l'état de cette surface*, Paris 1802. (cf. Darwin's Second Notebook MS. p. 119.)

[5] William Darwin Fox. Probably personal communication.

[6] Erasmus Darwin. *Zoonomia*, vol. 1, London 1794, Section XXXIX.

[7] Thomas Livingstone Mitchell. *Three Expeditions into the Interior of Eastern Australia*, . . . London 1838, vol. 1, pp. 244, 245.

[8] These words were crossed out in MS.; they refer to MS. p. 175 below.

[9] William Yarrell. Personal communication.

75 Mitchell[1] Australia vol. I, p. 306 " The crows were amazingly bold, *always accompanying us from camp to camp* ; it was absolutely necessary to watch our meat, while in kettles on the fire, & on one occasion, not withstanding our vigilance a piece of pork 3 lb was taken from a boiling pot, & carried off by one of these birds ". Case of birds of different family having very same habits in some respects as the Cara cara. |

76 Sept. 9th It is worthy of observation that in insects where one of the sexes is little developed, it is always female which approaches in character to the larva, or less developed state. —

The female & young of all birds resemble each other in plumage. — (That is where the female differs from the male?) children & women — " women recognized inferior intellectually ". Opposed to these facts are effects of castration on males & of age or castration in females. — |

77–90 *excised.*

91 This keeper has seen when sickly tigers have first come over, insects somewhat like between lice & fleas, sticking on them, — but never in an animal, that had long been in confinement — is this effect of climate, or state in which they are kept ? —

Is there any mistake about Yarrell's law,[2] is it *local* (not *artificial* variation) which impresses offspring most & *not time* thinking of the Penguin duck & Herbert's law of ideosyncracy[3]. |

92 I have hitherto thought that a small difference of any kind, if very firmly fixed from long time, made no difference what its kind was, — but if it were *opposed* to the difference in other sex, it would be much more difficult to propagate — as if one bird had very bright red breast & other very bright blue, it might be harder for |

93 both parents to transmit their peculiarities, that if both had mottled breasts, of a sort that would allow the offspring to have some different kind of mottle, each feather partaking of character of other, — the *most* aquatic & most terrestrial species, might be harder to cross than two less opposed in habits, though externally similar. — this

94 however is a sophism for | their brain or stomach would be different. — Or if one species left its type in having very long legs, & another in having very long tail, & other in having very *short* tail. — I can readily see that two first might cross easier than two last. |

95–98 *excised.*

99 September 13th. The passion of the doe to the victorious stag, who rubs the skin of [f] horns to fight, is analogous to the love of women (as Mitchell remarks[4] seen in savages) to brave men. —

Effect of castration horns drop off, replaced by hairy ones, which never dry up & peal off their skin (not being wanted for war) & hence never fall off. Curious the rapidity of the change in 5 or 6 weeks after castration, fresh horns begin to grow.

[1] Thomas Livingstone Mitchell. *op. cit.*, vol. I, p. 306.

[2] William Yarrell. cf. Darwin's Second Notebook on Transmutation of Species, MS. pp. 1 & 121 (The supposition that the oldest variety has the greatest effect on offspring when crossed).

[3] William Herbert. *Amaryllidaceae*, London 1837. On p. 343 :—" In further confirmation of the fact that the sterility depends on constitutional discrepancy, or difference of what medical men call idiosyncrasy, . . . "

[4] Thomas Livingstone Mitchell. op. cit., vol. I, p. 304 :—" . . . the gins have it in their power on such occasions to evince that universal characteristic of the fair, a partiality for the brave."

— Mr Yarrell[1] says the male Axis of India, breeds at times when horns not perfect — (is not this so in S. America with C. campestris, refer to my notes) & Mr Yarrell supposes this a consequence of that female breeding all the year round. Ask Colonel Sykes[2]. |

100 Even our domesticated cattle have *tendency* to breed at particular times.

Mr Yarrell has old book 1765 ? Treatise on Domestic Pidgeon,[3] in which it appears that all the varieties now known were then existing. — he has also some very fine recent drawing of prize pidgeons in 1834. — now this would be most curious to show that in sixty years (how many generations) the strangest peculiarities have been kept perfect — also to trace the laws of change in this time. — The impossibility of discovering their origin. — I see only some, but very strange races of them have the forked black mark of the Rock Pidgeon, — several have a group |

101–106 *excised.*

107 which it must have taken to separate Van Diemens Land from Australia &c. &c.

September 14th. When Macleay[4] says there is no difference between " permanent varieties " & species, he overlooks those restricted in their range by man & by art — the former only giving average of effects of country (& no monstrosity or adaptations to unhealthy state of womb). —

One can perceive that natural varieties or species, all the structure of which is adaptation to habits (& habit second nature) may be more in constitutional,—more conformable to the structure which has been adapted to former changes than a mere monstrosity propagated by art. |

108 Yarrell[5] told me of a cat & of a dog born without front legs — the former of which had kittens with imperfect ones, — now Sir J. Sebright[6] thought if he had had a pair he could have produced from them — this instance of monstrous variety which could not have been persistent in nature. —

According to my view, the domesticated animals would cease being fertile inter se, or at least show repugnance to breeding if instincts unchanged, & if their characteristic qualities were all deeply imbued in them from long permanence, so that all their peculiarities must be transmitted if their |

109–110 *excised.*

111 every case common to many good species, & therefore to genera (& the uncles & aunts) & therefore does not tell against transmutation of species — will it against genera. — How long will the wretched inhabitants of N.W. Australia go on blinking their eyes without extermination, & change of structure. — When will the mosquitoes of S. America take an effect — would perfect impunity from moskitoes bite influence propagation of species. —

[1] William Yarrell. Personal communication.

[2] Col. William Henry Sykes, author of the " Catalogue of Mammalia of Dukhan ", *Proc. Zool. Soc. Lond.*, 1831, vol. 1, p. 95 :—cf. *Variation of Plants and Animals under Domestication*, 1868, vol. 1, p. 62.

[3] The book referred to is probably *A Treatise on Domestic Pigeons, comprehending all the different species known in England . . . to which is added a . . . description of that celebrated . . . pigeon called the Almond Tumbler*, London 1765.

[4] William Sharp Macleay. " Annulosa " in A. Smith : *Illustrations of the Zoology of South Africa*, London 1838, p. 8, footnote. (cf. footnote to MS. p. 52 above.)

[5] William Yarrell. Personal communication.

[6] Sir John Sebright. Probably personal communication.

Case of association very disagreeable hearing maid servant cleaning door outside as often as she touched handle, though really fully aware she was not coming in, — could not help being perfectly disturbed, referred to Book M.[1] |

112 Is there any *law of variation* (as Hunter[2] supposes with *monsters*) — if armless cat can propagate, i.e. with the chance of two being born at same time, & make breed, one would doubt any law. — yet seeing the feathers along one toe of the Pouter one thinks there is a law, — that there must have been a tendency for feathers to grow there. That mutilations will not alter form may be inferred from Australian knocking out teeth. — The account of the people on the N.W. Coast blinking to keep out flies might be used.

The wild ass has no *cross*, how comes it that the tame donkey has. Old Buffon[3] should be read on mare.

My view why hybrids are infertile, supposes that when foetus is forming the ovum within it is forming & this must be so else avitism could hardly ever occur. — and if that cannot be formed, generat. organ by that co-relation of parts will not be produced. — |

113–114 *excised.*

115 p. 482 (same book, Hunter Animal Economy) Owen says[4] " the necessity of combining observation of the living habits of animals, with anatomical & zoological research, in order to establish entirely their place in nature, as well as fully to understand their oeconomy, is now universally admitted ". — p. 483 Owen[5] thinks from climate of Australia & from Ornithorhynchus & Hydromys not being Marsupial (but *also mice*) & there being water animals these structures " may have reference to the great distances which the mammalia of N.S. Wales are generally compelled to traverse in order to quench their thirst " — But *New Guinea*!! S. America. — Such difficulties will always occur if animals are thought to have been created. — it might as well be attempted to be shown from peculiarities of climate cause of N. Zealand not having any Mammalia. — Type of geographical organization. No more can be said |

116 In paper on bees in same work it is said[6] that some kinds lay up honey even for single rainy day — & from case of wasps is supposed cells properly are made for larvae. — (p. 451) — Wasps breed many females, but almost all die — bees breed but few, because they are kept in security. — Hunter doubts about production of Queens. — Neuters are bred first, then males — how has this been arranged — Neuters are true female, but with parts little developed. —

Sept. 19th There is no scale according to importance of divisions in arrangement,

117 of the perfection of | their separation. — Thus Vertebrata blend with Annelida by some fish. — But birds quite distinct. —

[1] The reference is to Darwin's First Notebook on Metaphysics, Morals and Expression.

[2] John Hunter in Richard Owen : *Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London 1833, vol. 1, p. iv.

[3] Georges-Louis Leclerc, Comte de Buffon. *Histoire naturelle. Quadrupèdes*, Paris.

[4] Richard Owen in John Hunter : *Observations on certain parts of the Animal Oeconomy with Notes by Richard Owen*, London 1837, p. 482, footnote 1.

[5] Richard Owen in John Hunter. *Ibid*, p. 483, footnote.

[6] John Hunter. *Ibid*, p. 451, " On the number of Queens in a hive ".

Collect cases of difficulty of growing plants in all parts of world, thus tea trees in Brazil must have degenerated, as must spices &c &c.

The line of argument often pursued throughout my theory is to establish a point as a probability by induction, & to apply it as hypotheses to other points, & see whether it will solve them. — |

118 It is less wonderful that childs nervous system should build up its body like its parent than that it should be provided with many contingencies how to act. — So with the mind the simplest transmission is direct instinct & afterwards enlarged powers to meet with contingency. —

Sept. 23rd. Saw in Loddiges[1] garden 1279 varieties of roses!!! proof of capability of variation. — Saw his collection of Humming birds, saw several greatly developed tails & one with beak turned up like Avocette. here is what |

119–126 *excised.*

127 that it shall beget young different in colour, form, & so altered in disposition as to be more easily trained up to the offices " &c. &c.

Owen illustrates[2] case of Dingo (he alludes to the Dholes or wild dogs of India) in Zoolog. Garden having coloured offspring — but surely in all these cases an unseen change is produced in parent — colour is a doubtful subject, but what other instances are there of such changes, *not* acquired by parent, being handed down ? |

128 Are not Loddiges[3] 1279 roses kept in same soil, same atmosphere ? — may they not be transplanted ?, & yet year after year, successive roses & bud are produced, like parent stock or if different deteriorating very slowly. — I presume most of these roses, without circumstances very unfavourable, will continue of same variety as long as life lasts, yet they cannot transmit through seeds these characters though transmitting them with such facility to bud. — This must be owing to their unity

129 in one stem. — | A bud may be transplanted & carry all these peculiarities — not so a seed. — Bud probably is like cutting off tail of Planaria, claw added to crab, tail to lizard, healing of wound. — reproductive faculty simplest forms of budding. Why does Gecko produce always different tail ? The whole grown to that part — in the separated part every element of the living body is present, in generation something is added from one part of the body, (or of other similar, body) to another part of body. — (in plants does not whole individual change into generative organs?) it is of no consequence if it does — Do plants loose any qualities by being buds — more than if whole branch transplanted ? |

130 An individual bud may be thus produced from the growth of one part, (not strictly new individual) or he may [be] produced by having undergone the endless changes which its parents have, — not this is effected by short method in *generation.* —

[1] Conrad Loddiges. *Catalogue of Plants in the Collection of Conrad Loddiges & Sons, Nurserymen at Hackney near London.* 13th edit. London 1823, p. 33 gives Rosa fl. simpl. 1205 ; 15th edit. London 1830, p. 57 gives Rosa fl. simpl. 1470. Presumably Darwin worked from the 14th edition.

[2] Richard Owen in John Hunter. *Op. cit.*, p. 330, footnote :—" The existence of wild dogs which are not wolves, as the Dingo of Australia and the Dhole of India, which have either lost or have never acquired the common character of domestication, variety of colour, it is itself a strong argument against the original of the domestic dog ever having been a wolf."

[3] Conrad Loddiges. op. cit.

Ehrenberg[1] considers artificial division of animals as gemmation. I consider gemmation as artificial division. — On this view each particle of animal must have structure of whole comprehended in itself, — it must have the knowledge how to grow & therefore to repair wounds — but this has nothing to do with generation.

Why crab can produce claw but man not arm, hard to say. — |

131 if it were possible to *support* the arm of man,[2] when cut off, it would produce another man. — That the embryo the *thousandth* of inch should produce a Newton is often thought wonderful, it is part of same class of facts, that the skin grows over a wound. —

Does likeness of twin bear on the subject ?

A mans arm would produce arm if *supported*, & in making true bud some such process is effected, — a *child* might be so born, but it would be very different from true generation, — there is no caterpillar state : the vast difference of two kinds of generation shown by their happening in same plant. — |

132 The Marsupial structure shows that they became Mammalia, through a different series of changes from the placentalia. Having hair like true Mammalia, no more wonderful than Echidna & hedgehog having spines. —

Does not male pidgeon (yes surely) secrete milk ? from stomach, analogous to other males feeding young, & to abortive mammae in male Mammalia — ?is not this argument for mammalia recent creation. — why what tendency can there be for abortive organ ever disappearing ?? — Have Marsupiata abortive mammae ? —

My view would make every individual a spontaneous generation : what is animalcular semen but this — the living nerve massed in mould. — |

133–136 *excised.*

137 it, & made it meet in front. — Dr Smith[3] every baboon & monkey, big & little that ever he saw knew women. — he has repeatedly seen them try to pull up petticoats, & if women not afraid, clasp them round waist & look into their faces & make the st. st noise. — The cercopithecus chinensis? (or bonnet faced) monkey he has seen do this. — These monkey[s] had no curiosity to pull up trousers of men. Evidently knew women, thinks perhaps by smell, — but monkeys examine sexes of every [animal]. |

138 Has repeatedly seen one he kept pull up feathers of tail of Hen, which lived with it, — also of dogs *but did not seem to evince more lewdness for bitch than dog* : monkeys thus examine each other sexes by taking up tail. — Mem.: Ourang Jerry with Tommy. — Good evidence of knowledge of woman. —

The noise st st which the C[ercopithecus] sphingiola makes is also made by the C. porcarius, together with a grunting noise, the former signifies recognition with

139 pleasure, as when food is offered, as much as to | say give me — the other when Dr Smith more distant. — But he thinks other monkeys make st. — noise. In case of woman instinctive desire may be said more definite than with bitch, for some

[1] Christian Gottfried Ehrenberg. *Athenaeum*, 1838, 8th Sept. p. 653. (8th Meeting of the Brit. Assoc. Adv. Sci., Section Zool.) " . . . believes that process of multiplication by division to be merely the development of a gemma or bud . . . "

[2] Darwin is using the expression " to support the arm of a man " in the sense of keeping it supplied with its physiological requirements. An anticipation of tissue culture by 70 years.

[3] Dr. Andrew Smith. Personal communication.

feeling must urge them to these actions. These facts may be turned to ridicule, or may be thought disgusting, but to philosophic naturalist pregnant with interest.

Hyaena, thinks, when pleased cocks his ears, when frightened depresses them.

England was united to Continent when elephants lived, & when present animals lived — we know the great time necessary to form channel & (& Basses St.) yet no change in English species — time no element in *making* change, only in *fixing* it : only circumstances a contingency of time. |

140 When we multiply the effects of earthquakes[1], elevating forces in raising continents, & forming mountain-chains, when we estimate the matter removed by the waves of the sea, on beaches, we really measure the rapidity of change of forms, & instincts in the animal kingdom. — It is the unit of our calendar — epochs & creations reduce themselves to the revolutions of one system in the Heavens. —

Is not *puma* same colour as *lion* because inhabitant of *plain* & Jaguar of woods &c like ground birds. |

141–152 *excised.*

153 If an animal breeds young her growth is immediately checked — the *vis formativa* goes entirely to the offspring — This is clearly the converse of animal being rendered inessential, the hardness of life in female moth &c.

Mr Y.[2] says that Macleay considers the house bug, as a female which has larvae which have bred before the vis formativa had completed them — (but the argument is *very weak* without knowing whether if kept they would have wings. —). — Says p. 84. Hens like Cocks from effect of heredity in & in. — Mr Yarrell does not know

154 of any case of old male becoming like female, though many | of old female becoming like cocks. — It is very singular so many Gallinaceous birds have cock & hen plumage so different, yet the Cassowary & Guinea fowl cannot be distinguished. —

A capon will sit upon eggs as well as & often better than a female. — this is full of interest, for it shows latent *instincts* even in brain of male. — Every animal surely is hermaphrodite — (as is seen in plumage of hybrid birds) |

155 After animal has copulated, though no offspring, milk sometimes comes in mammae, & even when bitch is in heat. —

Yarrell believes gestation is always some multiple of seven — if woman does not menstruate in the month, she will in 5 weeks. —

A Bull is never taken from his own field to bull a cow. — A dog if led in string will not. — Some of the tigers — cat, though caterwhalling & put into female when muzzled, he is disabled. — so elephant in confinement, & so *imagination* in man, has strange effect. — |

156 *Directly* a capon is cut, it increases in size *prodigiously* —

Animal Oeconomy by Hunter (edited by Owen) p. 34, — Owen[3] classifies Hermaphrodites Cryptandrous (only female organs visible) Oyster, Cystic Entozoa, Echinoderms, Acalephes, Polyps, Sponges.

Heautandrous, male organs formed to fecundate females (as in plants) Cirrhipeds, rotifers, trematode and cestoid Entozoa.

[1] This word crossed out in MS.
[2] William Yarrell. Personal communication.
[3] Richard Owen, in John Hunter. *Observations on certain parts of the Animal Oeconomy with Notes by Richard Owen*, London 1837, footnote on p. 35 (not p. 34).

Allotriandrous Mollusca, with [*recte* without] pectinibranchiate order — the Annelida, all other[1] are Dioecious as Cephalopods, pectinibranciate molluscs, insects, spiders crabs — (all these however do not require coition every generation) Epizoa, the nematoid Entozoa —

Therefore highness in scale has no constant relation to separation of sexes, as may
157 be | seen in Monoecious & Dioecious plants. —NB. in Heautandrous animals is there gradation of structure leading to supposition, that the Cryptandrous are really Heautandrous. — How is fecundation effected in latter ; are organs open to water ? Would not ferns according to this doctrine be considered as really cryptandrous, & they have hybrids — This is most important support to my views — Seeing sexes separate in some of the lowest tribes, leads one to suppose still more that they must in effect be so in all. — 2 NB. In Pectinibranch mollusca or Cephalopoda are there abortive traces of other sexual organs ; for if so, separation of sexes very simple — as in plants. Even in same genus some dioecious & some monoecious — (& cultivation might make one set of organs barren in one plant & not in other). Hunter p. 36 is thought by Owen[2] to ask whether a Heautandrous animal is actually split in two — keeping sexes separate. Owen says such view worthy of a Lamarckian. — Mine is much simpler. — |

158 Hunter[3] shows almost all animals subject to Hermaphroditism, — those organs which perform nearly same function in both sexes, are never double, only modified, those which perform very different, are both present in every shade of perfection. — How comes it nipples though abortive, are so plain in man, yet no trace of abortive womb, or ovarium, — or testicles in female. — the presence of both testes & ovaries in Hermaphrodite — but not of penis & clitoris, shows to my mind, that both are present in every animal, but unequally developed. — surely analogy of Molluscs & neuter bee would shew this. (Do any male animals give milk) — But this not distinctly stated by Hunter,[4] — Do testes, & ovaria when |

159–160 *excised.*

161 Hunters Animal Oeconomy (by Owen)[5] p. 44 Classification of Monsters (1) from præternatural situation of parts, (2) addition of parts, (3) deficiency of parts, (4) combined addition and deficiency of parts, as in Hermaphrodites. (shows my doctrine of Hermaphrodite differs from Hunter) — Hunter[6] (p. 45) observes " every species has a disposition to deviate from Nature in a manner peculiar to itself ". Each part of each species not similarly subject. —.

Divides sexual marks into primary & secondary, the latter only being developed when the first become of use. Great characteristic of male greater strength — (p. 45) and that strength[7]

In speaking of generation always put female first.

Will not even a fruit tree or rose degenerate during its life so that successive buds

[1] The word "animals" here crossed out in MS.
[2] Richard Owen, in John Hunter. *Ibid*, p. 36 footnote c.
[3] John Hunter. *Ibid*, " An account of the Free-Martin", p. 36.
[4] John Hunter. *Ibid.*
[5] Richard Owen in John Hunter. *Ibid*, p. 44 footnote.
[6] John Hunter. *Ibid*, p. 45 " An account of an extraordinary pheasant ".
[7] This sentence was crossed out by Darwin.

do differ — any variety is not handed down but is handed down for some generations. |

162 Theory of sexes (woman makes bud, man puts primordial vivifying principle) one individual secretes two substances, although organs for the double purpose are not distinguished, (yet may be presumed from hybridity of ferns) afterwards they can be seen distinct (in dioecious plants in their abortive sexual organs?) : they then become so relates to each other as never to be able to impregnate themselves (this never happens in plants, only in subordinate manner in the plants which have male & female flowers on same stem. —) so that Molluscous hermaphroditism takes place. — thus one organ in each becomes obliterated, & sexes as in Vertebrates take place. — .·. every man & woman is hermaphrodite : — .·. developed instincts of capon & power of assuming male plumage in females, & female plumage in castrated male. — Men giving milk — |

163 Sept. 25th Young man at Willis[1] Gt Marlborough St Hair dresser assures me he has known many cases of bitch going to mongrel, & all subsequent litters having a throw of this mongrel. — I did not ask the question. — His bitch will not take, & if she did take, probably would not be fertile, without she knows & *likes him* & then is actually obliged to be held, — like she wolf of Hunter[2] — there is great difference between hybrids & inter se offspring in latter being unhealthy. — young take distemper very readily & are subject to fits. — *Males bred in & in never lose passion.* (mem. so it was said little cock yet very bad losing virile powers in Zoolog Gardens & Kings at Otaheite) Last litters are considered the most valuable because smallest sized dogs, — one litter big & then second small & so [on]. — Says there is breed of

164 Fowls called everlasting layers — or Polish breed (He thinks | half pheasant, half fowls) — eggs fertile but parent bird will never sit on them. —

May be just worth remembering that ovarium of women (Paper in Vol. I of Irish Royal Academy)[3] have contained perfect *teeth* & hair, showing foetus has *gone on growing*, I believe same has happened in boys bodies.

Lavaters Essays on Phy[siognomy][4] transl by Holcroft vol. I, p. 195 says children resemble parents in their bodies " It is a fact equally well known, that we observe in the temper, *especially of the youngest children*, a striking similarity to

165 the temper of the | father, or of the mother, or sometimes of both ". If L. can be trusted this is Lord Moretons[5] law. — " How often do we find in the sons the *character*,

[1] Mr. Willis. Hairdresser cf. above MS. p. 24.

[2] John Hunter. *Ibid*, " Observations tending to show that the wolf, jackal, and dog, are all of the same species ", p. 319. On p. 324 :—" I communicated to Mr. Symmons my wish that we should endeavour to prove the fact of the wolf and dog being of the same species, by having either his female or mine lined by a dog."

[3] James Cleghorn. " The History of an Ovarium, wherein were found Teeth, Hair and Bones," *Trans. Irish Royal Acad.*, 1787, vol. 1, p. 73.

[4] John Caspar Lavater. The *Catalogue of the Library of Charles Darwin*, Cambridge 1908, lists this book as the French edition Paris 1820. In the translation by Holcroft (London 1840) on p. 369 the following words appear :—" . . . From all observations, on the resemblance between parents and children, which I have been able to make, it appears to me evident that neither the theory of Bonnet nor Buffon give any systematic explanation of the phenomena, the existence of which cannot be denied . . . sometimes, [they] resemble the mother, sometimes the father, often both, and often neither . . . " The edition which Darwin used has not been traced.

[5] Lord Morton. " A Communication of a singular fact in Natural History ", (read November 1820), *Phil. Trans. Roy. Soc.*, 1821, vol. cxi, p. 20.

constitution, & most of the moral qualities of the father !! In how many daughters does the character of the mother revive! Or the character of the mother in the son, & of the father in the daughters ! " This last remark good because showing probably not education. —

Cannot I find some animal with definite *life* & split it, & see whether it retains same length of life — like Golden Pippin trees ? How is this with buds of plants, does *annual* give buds. — Life may be thus prolonged, bud being formed & one part dying for great length of time. — |

166 There is probably law of nature that any organ which is not used is absorbed. — this law acting against hereditary tendency causes abortive organs. — The origin of this law is part of the reproductive system, — of that knowledge of the part of what is good for the whole — if cut off nerves in snail[1] (Encyclop of Anat & Phys) can make a head : the other parts may surely absorb a useless member, — in fact they do it in disease & injury. —

The *sympathy* of parts is possibly part of same general law, which makes two
167 animals out of one | & heals piece of skin, — if the tail knows how to make a head, & Head a tail, & the half both head & tail — no wonder there should be *sympathy* in human frame.

One of the final causes of sexes to obliterate differences, final cause of this because the great changes of nature are slow. if animals became adapted to every minute change, they would not be fitted to the slow great changes really in progress. —

Annals of Natural History, 1838, p. 123. Ehrenberg[2] makes gemmation in animals very different from that of plants (though latter does sometimes occur in animals). latter the division taking place from outside inwards & in animals from inside to the outside. is this not owing simply to more importance of internal regions in animals. One invisible animalcule in four days could form 2 cubic stone, like that of Billin [Bilin] |

168 It[3] is very singular the same difference from parental stock having been repeated several times, that it becomes fixed in blood. — Looking at ovum of mother & ovum in offspring, as similar to the several ova in mother (with only difference of time) is the above law anyways connected with the case of successive copulation impresses offspring more & more with the added difference, like Lord Moretons[4] case & Dr Andrew Smith,[5] If A.B.C.D.E. be animals : if (X) male impresses ovum in A with

[1] T. Rymer Jones, " Gastropoda ", *Encycl. Anat. & Phys.*, London 1839, vol. 2, p. 396. Regeneration of the tentacles in snails was first demonstrated by Spallanzani and published in 1768. His results were confirmed by Voltaire in the same year. (Sir Gavin de Beer. *Science and the Humanities*, London, 1956).

[2] Christian Gottfried Ehrenberg. " Communication respecting Fossil and Recent Infusoria made to the British Association at Newcastle ", *Ann. Hist. Nat.*, 1838 (1839), vol. 2, p. 121. On p. 123 :—" ... or as many individual animalcules as contained in 2 cubic feet of the stone from the polishing slate of Bilin. This increase takes place by voluntary division ; and this is the character which separates animals from plants. It is true that the gemmation in plants, especially in very simple cells, is at times very similar to the division in animals, but this relates to the form not to the formation. A vegetable cell apparently capable of self division always becomes one, or contemporaneously many exterior warts (gems) without any change in its interior. An animal which is capable of division first doubles the inner organs, and subsequently decreases exteriorly in size. Self division proceeds from the interior towards the exterior, from the centre to the periphery ; gemmation, which also occurs in animals, proceeds from the exterior towards the interior, . . . "

[3] At the top of the page are the words "Generation [crossed out] v, p. 152."

[4] Lord Morton' op. cit., p. 20.

[5] Dr. Andrew Smith. Reference untraced.

some peculiarity that is (B) to some degree, & likewise ovum in (B) that in (C) in lesser degree — Then when (C) unites with male (X)[1] assume that every peculiarity
169 has a tendency to descend to several generations | If A & B be two animals which have some peculiarity for first time, & if their all their offspring inherit the same peculiarity in lesser degree & theirs again in lesser degree — now if the second race both have this peculiarity strongly ; they transmit with same force as first pair, but to this tendency is added the 3rd tendency from first pair. — Now if two of third pair of same peculiarity breed they will have the same influence as first pair + tendency they inherited from second pair, + the influence they themselves *inherit.*

Annals of Natural History[2] p. 96, vol. I. [*recte* II] Notice the Syngnathus or Pipe fish the male of which receives eggs in belly. — Analogous to men having mammae. — |

170 There is an analogy between caterpillars with respect to moths, & monkeys & men, — each man passes through its caterpillar state. The monkey represents this state. —

When it is said, that difference between bud & seed, that latter carries with [it] stock of food, — the generalization begins low — it goes through transformation nearly independently of its parent therefore wants independent supply of food, — is real difference — but this does not apply to potato. |

171 With respect to offspring being determined by impregnation of mother — we see in a litter every possible variation from being very near mother, & some very near father. — Now if one of these staid in the womb, when it came out, it might partake of shade of fathers character. — according to this view more semen to one child, more like father. — Stuff! — |

172 How much opposed the Quagga case appears to that of 2 dog[s] begetting different puppies out of same mother. —

The following views show the transmission of mutilation impossible it should be observed that transmission bears no relation to *utility* of change. hence *hare-lips* hereditary, *disease,* extinction.

The view that man or cock pheasant &c is abortive hermaphrodite is supported by change which takes place in old age of female assuming plumage of cock, & beards growing in old women — Stags horns & testes curious instance of corelation in structure — Neuter bee having both sexes abortive fact of same tendency. — Mammae in men having given milk, testes & ovaria. —

Animals in domestication (mem. elephant) not breeding — remarkable. Athenaeum 1838, p. 653. Ehrenberg[3] thinks multiplication by division in developement of gemma |

173–174 *excised.*

175 Why are twin[s] in man more like each other, than twins or triplets &c or in litter. Why is there some law about sexes of twins in former case. — (many monsters are really twins.) —

It is absolutely necessary that some but not gre.t difference (for every brother & sister are somewhat different) should be added to each individual before he can procreate. then change may be effect of differences of parents, or external circumstances during life. — if the circumstances which must be external which induce

[1] From the words "If A.B.C.D.E " to here crossed out in MS.
[2] B. F. Fries. " On the genus Syngnathus ", *Ann. Nat. Hist.*, 1838 (1839), vol. 2, p. 96.
[3] Christian Gottfried Ehrenberg. *Athenaeum*, 1838, 8th Sept., p. 653.

change are always of one nature species is formed, if not — the changes oscillate backwards & forwards & are individual differences. (hence every individual is different). (All this agrees well with my view of those forms slightly favoured getting the upper hand & forming species.) — (Aphides having *fertile* offspring without coition or addition of differences, shows that difference need not be added *each time*, but after some time.)

What kinds of plants are monoecious or dioecious. Very curious how this was superinduced ? (Surely all are really *dioecious*) only simple forms of life are monoecious. |

176 Proved facts relating to Generation.

One copulation may impregnate one or many offspring, it affects the subsequent offspring, though other male may have copulated. — two animals may unite & each have offspring by same mother. — one animal will fecundate female for several births, & even produce fertile offspring. — *Desire lost* when male & female too closely related : this most important with regard to theory, showing generation connected with whole system, as if there was a superabundance of life like tendency to budding, which wishes to throw itself off, — as may be inferred from annual plant being prolonged till it has bred. — Offspring like both father & mother, or very close to either. — Male & female as foetus one sex ; & therefore both capable of

177 propagating, but one is rendered abortive | as far as parturition is concerned. — Generation being means to propagate & perpetuate differences, (of body, mind & constitution) in the end frustrated, when near relations & therefore those very close are bred into each other. — this is somehow connected. (This seems case, for by careful observing cattle can be bred in & in.) — The life of *passion* in hybrids perhaps connected with this same case (& not merely as I have stated it) it is certainly very remarkable that too much difference should produce same effect as too little, — in (latter case female often takes males but does not produce) tendency to deformity this does not happen with hybrids ? Plants must stand much breeding in & in (those which have solitary flowers) exotics brought from foreign country & so must those forms which are produced by budding only as cryptogams & hydras — (this repugnance to breeding in & in seems connected with more developed forms). Study buds — gemmae & monocotyledonous, do those which are monocotyledons have many flowers in same spath, as they have only one *bud*. — |

178 Every individual foetus would reproduce its kind was it not for the necessity of some change. Without some small change in form, ideosyncrasy or disposition were added or substracted at each or in *several* generations, the process would be similar. to *budding* which is not object of generation. — therefore passions fail. — In fruit trees no doubt there is tendency to propagate the whole difference of parent tree, but it fails. Therefore crab seedlings of one apple ought to differ from those of other. — The upshot of all this is that effect of male is to impress some difference to make the *bud* of the woman not a bud in every respect. — Is this connected with the physical differences in almost all male animals ? If the male in the case of some generations has gained some difference from what it received (for it is probable that breeding more in would not be deleterious if the relation had come from different quarters) then it causes a secretion of something someways different from himself, for it

179 should be observed that from | the effects of breeding in, it is not merely the too

close animals which will not breed, but the female at least (?male?) looses all appetite. — It is the comparison of each animal with its ancestors, and not its comparison of difference with other sex.

The highest bred Blood hound would be infertile with highest bred of other ? breed. Therefore it is not really breeding in & in but breeding animals that have neither varied from their stock, for to breed (as Sir J. Sebright[1] urges?) one with opposed characters is by impliance to breed two which have each varied from parent stock. — The very theory of generation being the passing through whole series of forms to acquire differences, if none are added, object failed, & then by that corelation of structure, desire fails. Every individual except by incestuous marriage has acquired from father some differences v. Sykes.[2]

Books to read Buffon Suites[3] &c. — Horse & cattle Library of useful Knowledge.[4] Bell's Quadrupeds.[5] |

180 Will ova of fishes & Mollusca & Frogs pass through birds stomachs & live ?

In Muscovy ducks do young take most after father or mother, according as they are crossed ? & how is it with China & Common geese. How are their instincts ? Chinensis & Common pigs. —

Experimentize on crossing of the several species of wild fowl of India, with our common ones in Zoolog. Gardens[6] :

Buffalo, common cattle, Esquimaux (& Australian) dogs with common dogs[6] —

Ask my father to look out for instances of avitism.

Examine English breeds in hot houses, will they flower.

Make Hybrids with moths, where fecundation can be made artificially. — |

Inside back cover :

Are hybrids pintail & common duck similar inter se ? Zoolog. Gardens.[6]

Are the hybrids of those species which cross & are fertile heterogenous ?

When bird fanciers say the throw of two varieties is uncertain do they mean they cannot tell first result, or that hybrid breed is uncertain.[6]

Is there any peculiarity or variation common to any zoophyte both in succession which is not transmitted by generation ??

Is it chiefly in high bred dogs i.e. (bred in & in) that one copulation with other dogs renders subsequent progeny faulty. Does male fail in passion. —

Disposition of half bred cattle at Combermere ? How is jackall & dog of Z. Gardens.

[1] Sir John Sebright. Reference untraced.

[2] Col. William Henry Sykes. Reference untraced.

[3] *Collection des Suites à Buffon, formant avec les oeuvres de cet auteur un cours complêt d'Histoire Naturelle*, Paris 1834 (or other edition).

[4] William Youatt. "The Horse, with Treatise on Draught", *Library of Useful Knowledge*, Farm Series, 53, 1831 ; "Treatise on British Cattle, their Breeding, Management and Diseases", *Library of Useful Knowledge*, Farm Series, 51, 1834.

[5] Thomas Bell. *A history of British quadrupeds, including the Cetacea*, London 1837. This list of books is at the top of the page and crossed out in MS.

[6] This sentence is crossed out in MS.

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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

PART IV

Edited with an Introduction and Notes by
SIR GAVIN DE BEER

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES Vol. 2 No. 5
LONDON: 1960

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES PART IV. FOURTH NOTEBOOK (OCTOBER 1838—10 JULY 1839)

Edited with an Introduction and Notes

BY

SIR GAVIN DE BEER

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13 OCT 1960
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SIR GAVIN DE BEER

PART IV. FOURTH NOTEBOOK. (OCTOBER 1838 TO 10TH JULY 1839)

INTRODUCTION

DARWIN'S Fourth Notebook on Transmutation of Species was written after he had read Malthus's[1] *Essay on the principle of population* on 3rd October, 1838. The first two pages subsequently cut out by him and now lost, were doubtless devoted to Malthus's work, as is the third page. Considering the importance of the influence which Malthus's book was thought (even by Darwin himself in later life) to have exerted on Darwin's work and ideas, it is significant that he devoted so little space to Malthus in the Notebook which he wrote immediately after reading his book. The reason, as explained in the Introduction to Darwin's Third Notebook on Transmutation of Species,[2] is that Darwin had already and independently thought out the principle of selection of favourable variations and seen the possibility that the transmutation of species might be explained by its means. What Malthus gave Darwin was evidence of the rigorousness of selection and of the inevitability of widespread mortality.

To this concept, Darwin introduced the notion of extinction as the extreme case of depopulation (IV 3), and the notion of variation; and he showed that he was well aware that this would lead to results very different from those which Malthus thought that he had achieved. This fact emerges clearly from the only other passage in the Fourth Notebook where Darwin refers to Malthus and is concerned to show that he does not subscribe to Malthus's assumption that the variation possible in cultivated plants and domestic animals is strictly limited. "It may be said that wild animals will vary according to my Malthusian views, within certain limits, but beyond them not, — argue against this" (IV 136). The term "Malthusian views" does not mean acceptance of Malthus's economic and political system, but solely adherence to the view that mortality ensues from reproduction outstripping food-supply. The parallel between the effects of artificial selection in producing new breeds of cultivated plants and domesticated animals, and of natural selection in producing new species is clearly formulated: "It is a beautiful part of my theory,

[1] Darwin used the 6th edition, London 1826.

[2] *Bull. Brit. Mus.* (*Nat. Hist.*) Historical Series, vol. 2, part 4, 1960.

that domesticated races of organics are made by precisely same means as species — but latter far more perfectly and infinitely slower" (IV 71).

A soliloquy on the mechanism of natural selection takes the following form: "it is difficult to believe in the dreadful but quiet war of organic beings going on in the peaceful woods and smiling fields" (IV 114). The fact that natural selection applies to man is adduced as additional evidence that man is of similar nature to animals. "When two races of men meet, they act precisely like two species of animals, — they fight, eat each other, bring diseases to each other &c., but then comes the most deadly struggle, namely which have the best fitted organization, or instincts (i.e. intellect in man) to gain the day" (IV 63). It is not difficult in this passage to recognize experiences which Darwin underwent during the voyage of the *Beagle*.

With regard to the evolution of man and the question whether his ancestors were bimanous or quadruped, Darwin had already seen the importance of embryonic development and vestigial organs in determining affinity and therefore descent. "There being no fossils, the only way, that I can see to discover whether the parent of man was quadruped or bimanous, is to see, what parts of structure abortive." (IV 66). That was written during the first half of December 1838, and on 6th January, 1839 comes the solution: "The rudiment of a *tail* shows man was originally *quadruped*" (IV 89).

Morals are the result of evolution from "social instincts, which as I hope to show is probably the foundation of all that is most beautiful in the moral sentiments of the animated beings" (IV 49).

The notion of fortuitous as distinct from designed variation is clearly expressed: "my principle being the destruction of all the less hardy ones & the preservation of *accidental* hardy seedlings" (IV 111). That survival is not fortuitous but is undesigned emerges from the following passage: "seeing the beautiful seed of a Bull Rush I thought, surely no 'fortuitous' growth could have produced these innumerable seeds, yet if a seed were produced with infinitesimal advantage it would have better chance of being propagated" (IV 137).

The "tendency to progression" postulated by Lamarck as an inherent quality of living organisms which would make natural selection unnecessary in those cases where it has resulted in improvement, quickly attracted Darwin's attention as a principle to be tested. "See if any law can be made out, that varieties are generally additions, & not abortive: with reference to the non-necessity of the so-called progressive tendency law" (IV 70). Soon comes the answer, and it opens up the whole science of ecology: "The enormous *number* of animals in the world depends of their varied structure and complexity. — hence as the forms became complicated, they opened *fresh* means of adding to their complexity" (IV 95). Here Darwin shows that he has realized the part which organisms themselves play in the complex of factors which make up the environment of other organisms. He continues: "but yet there is no *necessary* tendency in the simple animals to become complicated although all perhaps will have done so from the new relations caused by the advancing complexity of others. — It may be said, why should there not be at any time as many species tending to dis-developement, . . . my answer is because, if we begin

with the simplest forms & suppose them to have changed, their very changes tend to give rise to others" (IV 95). Darwin concludes: "I doubt not if the simplest animals could be destroyed, the more highly organized would soon be disorganized to fill their places" (IV 96). Improvement, where it takes place, is not the result of any innate tendency to progression, but to competition and adaptation. "Considering the Kingdom of nature as it now is, it would not be possible to simplify the organization of the different beings, . . . without reducing the number of living beings — but there is the strongest possible [tendency] to increase them, hence the degree of developement is either stationary or more probably increases" (IV 97).

The ecological web of life is so closely netted that when transmutation of species results in the origin of a new one, a new problem is created. "When a species becomes rarer, as it progresses towards extermination, some of the species must increase in number where then is the gap for the new one to enter?" (IV 43). The solution to this problem is closely connected with the principle of divergence[1] which Darwin did not solve until 1852.

Darwin was alive to the problems of what are now known as ring-species. "Lyell tells me . . . that Hooded crow and Carrion crow have in Europe different ranges latter not going north of the Elbe, yet they meet in one wood in Anhault & there every year produce hybrids" (IV 101, 102).

It is curious to find Darwin speaking of final causes regarding the existence of separate sexes, but the analysis developed in this and the following two pages of the consequences of their existence, and of what the result would be if there were only unisexual generation, is remarkably acute, particularly the realization of the advantages accruing from slow change in adaptation to the general conditions of the habitat instead of rapid changes in adaptation to local conditions (IV 48, 49, 50). Variation would be entirely unconnected in any groups of individuals and change would be unarchic. Furthermore, physical factors would act on individuals without restraint. The value of sexual reproduction is therefore that it canalizes variation into a small number of channels by making physical factors act not on single individuals but on interbreeding populations, and it slows down change with the result that changes can "bear relation to the whole changes of country, & not to the local changes" (IV 50).

Researches into the progress of ideas in the minds of those who solved the problem of evolution and natural selection are by no means complete, but it is already possible to see two curious patterns in the history of thought. The first relates to the manner in which arguments have simply been turned upside down as a result of progress of knowledge. The foremost example of this reversal of direction is the fate of Paley's arguments aimed at proving that the adaptations of plants and animals to their environment show evidence of purposive design.[2] First of all it must be remembered that Paley selected his evidence. There are not wanting cases of mal-adaptation. Every case of a parasite killing its host is a blunder of nature, reflecting no credit on

[1] In a letter which Darwin wrote to George Bentham on 19th June, 1863, *Life and Letters*, vol. 3, p. 26, he said: "I believe that it was fifteen years after I began before I saw the meaning and course of the divergence of the descendants of any one pair." If 1837 was the date when he began, this works out at 1852.

[2] William Paley: *Natural Theology*, London 1836.

any designer, and the same is true of many structures and functions, such as the prostate and the proneness of man to hernia as a result of his upright carriage. However, as a result of Darwin's work, the same facts as were adduced by Paley as proof of beneficent design are now recognized as evidence of what natural selection can achieve without any design at all. Indeed, if there were a designer, he would have to be singularly malevolent to produce all the failures and suffering caused.

Another case of inversion is provided by Lyell's attempt to use the principle of uniformitarianism to show that evolution could not have occurred, because catastrophism involved progressionism and catastrophism must be rejected.[1] Again as a result of Darwin's work, it is now clear that application of the principle of uniformitarianism shows that evolution must have occurred, because organic progressionism is the only correct interpretation of the facts in spite of catastrophism being erroneous.

Thirdly, both Lyell and Blyth[2] used the principle of natural selection, implicit in the penalization of variants from the specific type, to prove that species remain constant ; whereas Darwin and Wallace showed that this argument must be turned on its head to show that natural selection can make varieties depart indefinitely from the specific type. This last case is particularly instructive, because natural selection can in some cases bring about change and in other cases preserve stability, and T. H. Huxley[3] showed that natural selection was the only agency that could account for this facultative alternative. The reason for this is known, because Mendelian heredity is a mechanism which can according to circumstances produce diversity or stability. The former capacity is based on the power of mutation, crossing-over, segregation, and recombination of genes ; the latter on the particulate nature of the non-contaminating genes and on chromosome linkage.

Finally, the most remarkable case of all of reversal concerns the conclusion which Malthus drew from his argument based on the check which limitation of food-supply was supposed to impose on human fecundity and population increase. Since Malthus did not consider the possibility of variation in the population, he concluded that the results of checks to increase resulted merely in keeping numbers down, the quality of the population remaining the same as before. And since he believed that the practice of cultivation of plants and breeding of domestic animals showed that they were limited and not indefinitely perfectible, he concluded that the struggle for existence was an obstacle to the improvement of man just because it kept numbers down. In other words, Malthus's principle of population meant quantitative natural elimination without selection. As Conway Zirkle[4] has pointed out, Malthus was prevented from anticipating Darwin by his opposition to the ideal of human perfectibility embodied in the works of Condorcet[5] and Godwin.[6] Darwin and Wallace, independently, introduced into the argument the variability of plants and animals of which

[1] Charles Lyell : *Principles of Geology*, vol. 2, London 1832, See Introduction to *Darwin's First Notebook on Transmutation of Species* (*Bull. Brit. Mus.* (*Nat. Hist.*), Historical Series, vol. 2, 1960, p. 33.)

[2] Edward Blyth. See Introduction, *ibid.*, p. 36.

[3] T. H. Huxley : " Evolution in Biology ", *Encyclopaedia Britannica*, 9th Edition, vol. 8, p. 751.

[4] C. Zirkle : " Natural Selection before the Origin of Species ", *Proc. Amer. Phil. Soc.*, vol. 84, 1941, p. 101.

[5] Antoine-Nicolas de Condorcet : *Sketch for a Historical Picture of the Progress of the Human mind*, London 1795.

[6] William Godwin : *Enquiry concerning political justice and its influence on virtue and happiness*, London 1796.

they were aware both in artificial conditions and in nature. Familiar with the results of artificial selection, Darwin had already seen that selection in nature would cause species to vary from the original type ; and both he and Wallace, independently, saw that Malthus's principle of quantitative limitation working on natural populations must inevitably result in natural selection of the better adapted variants through a qualitative elimination, and they used the struggle for existence to explain the possibility of departure of varieties from the original type until they became new species ; which was exactly the opposite of Malthus's conclusion.

The second pattern in the history of thought is the realization that knowledge at a given time may already be sufficient to suggest the correct solution of a problem, if only the scientist knows where to look. The best example of this phenomenon, that science is sometimes richer than is imagined, is provided by Darwin himself. None of the ingredients which he required, both to establish the fact of evolution and to show that natural selection provided the explanation of how species become modified, was unknown to Lyell who missed the great chance, partly by failing to test the imaginary link between catastrophism and progressionism, and partly because his mind was orientated away from transmutation of species for reasons of theological orthodoxy. How close Lyell came to the facts without recognizing them may be seen in the second volume of his *Principles of Geology* published in 1832. There, in Chapter XI he actually speculated on the extinction of old species and the appearance of new species and asks (p. 179) " is it possible that new species can be called into being from time to time, and yet that so astonishing a phenomenon can escape the observation of naturalists ? " This problem was referred to in a remarkable letter dated 20 February 1836 from Sir John Herschel to Lyell, to which Darwin himself alluded in his Fourth Notebook (MS. page 59, below). The reference,[1] which I owe to Dr. Sydney Smith, is as follows : " Of course I allude to that mystery of mysteries, the replacement of extinct species by others. Many will doubtless think your speculations too bold, but it is as well to face the difficulty at once. For my own part, I cannot but think it an inadequate conception of the Creator, to assume it as granted that his combinations are exhausted upon any one of the theatres of their former exercise, though in all this, as in all his other works, we are led, by all analogy, to suppose that he operates through a series of intermediate causes, and that in consequence the origination of fresh species, could it ever come under our cognizance, would be found to be a natural in contradistinction to a miraculous process, although we perceive no indications of any process actually in progress which is likely to issue in such a result."

Another example is that of Sir Ronald Fisher's[2] demonstration that, far from being antagonistic and mutally exclusive, Darwinian selection and Mendelian genetics are complementary and indispensible to each other. Here, it was William Bateson who missed his great chance of effecting the synthesis by failing to recognize the fact that mutations may have infinitesimal and cumulative effects, and the possibility that selection might have played a part in controlling the effects of mutations. Al-

[1] Charles Babbage. *The IXth Bridgewater Treatise.* London 1837, p. 203. Darwin used the 2nd edition of this work which has not been consulted.

[2] R. A. Fisher : *The Genetical Theory of Natural Selection*, Oxford 1930.

though he had available to him all the basic ingredients out of which Fisher constructed his synthesis, Bateson was blinded by the clean-cut results of such Mendelian crosses as were known to him, appearing to have arisen ready-made without selection, and this prejudiced him against Darwinian selection. He was eventually driven to the untenable view that evolution had been stopped down at the start, and had occurred through the successive removal of inhibitory factors.[1]

The lesson to be derived from this is that even today there may be great syntheses waiting to be assembled from materials that are already to hand.

Darwin's Fourth Notebook on Transmutation of Species, also known as Notebook "E", is Darwin MS. 124 in the Cambridge University Library, to the authorities of which acknowledgement is warmly made for their unfailing assistance and courtesy.

As in the other Notebooks, a number of pages were cut out by Darwin in 1856, and seventy eight pages have thus been lost. Since the texts of Darwin's Notebooks on Transmutation of Species were sent to the press, some of the excised pages have been found in the British Museum (Natural History) and in the Cambridge University Library. These will be transcribed and published in a subsequent number of the Bulletin, together with Corrigenda and an Index of the names of persons referred to by Darwin.

Editorial Note

The general policy of this edition has been to present a text, which is already difficult enough in its contents, with the minimum of complication. It is not intended to be a facsimile edition.

The handwriting of the Notebooks is extremely difficult to decipher, because of letters indistinctly made, abbreviations and slurred endings to words, and ungrammatical construction of sentences. The use of capital and lower case letters is variable, as is the punctuation. The text is littered with dashes and with stops to which it would be misleading to attribute the value of periods in all cases. Many of them require the value of commas and are shown as such where the sense would otherwise be obscured. There are also several places where lines are drawn across the page, but no attempt has been made in this edition to reproduce them as rules. The use of different pens, inks, and of pencil here and there occurs frequently. In some cases the change appears to have no significance other than that he had temporarily run out of the instrument he had been using ; in other cases it means that entries were made subsequently, often between the lines, and these are noted where they appear to be significant.

Where words that are essential for the sense of the text were inadvertently omitted by Darwin they have been added between square brackets. In some places Darwin inserted square brackets, apparently subsequently, to indicate special emphasis and perhaps to show passages which he wanted to copy out. They have been indicated where significant by footnotes, but square brackets are exclusively reserved for editorial intercalations by me.

Two kinds of erasure occur in the text. In the first, words were resolutely struck

[1] William Bateson : "Evolutionary Faith and modern doubts", *Science*, vol. 55, 20th January, 1922.

out by Darwin because they were wrong and not what he meant to write, or because he changed the construction of his sentence. Since such words seldom serve any purpose in elucidating the sense of the text but add to its existing complexity, Darwin's own verdict on them has been accepted and they have been omitted without indication, save in exceptional cases. In the second type of erasure sentences or whole pages have been lightly scored through, doubtless to indicate that they have been dealt with, and such erasures have been ignored.

I do not doubt that even allowing for the simple editorial style here adopted, many misreadings of the text have been made, to which corrections will be welcomed for the Corrigenda and Addenda which it is hoped to publish; but if any reader requires more information than this edition gives, he must be referred to the manuscripts in the Cambridge University Library.

Acknowledgments

It is a pleasure to record my indebtedness to Sir Charles Darwin, K.C.B., F.R.S., in whom the copyright of the Darwin manuscripts is vested; the Syndics of the Cambridge University Library and to Mr. H. R. Creswick, M.A. Librarian, in whose care the manuscripts are preserved; to Lady Barlow for innumerable kindnesses and information of inestimable value for this work; to Dr. Sydney Smith for his kind criticism and invaluable help; to Professor S. L. Sobol of the Institute for the History of Natural Science and Technology of the U.S.S.R., Moscow, for the support of his agreement with my reading of the text of the First Notebook; to Mr. P. J. Gautrey of the Cambridge University Library for his valuable help in searching for missing pages of the Notebook; to Mr. A. C. Townsend, Librarian of the British Museum (Natural History); to Mr. M. J. Rowlands of the General Library, British Museum (Natural History), and to Miss Maria Skramovsky, my secretary, for their unremitting assistance in transcribing Darwin's handwriting and tracing references.

Gavin de Beer

Inside front cover.

Finished July 10th 1839. —
Selected Dec 15 1856 |

1–2 *excised.*

3 Epidemics[1] seem intimately related to famine, yet very inexplicable. —

ditto p. 529 " It accords with the most *liberal* ! spirit of philosophy to believe that no stone can fall, or plant rise, without the immediate agency of the deity.[2] But we know from *experience* ! that these operations of what we call nature, have been conducted *almost* ! invariably according to fixed laws : and since the world began, the causes of population & depopulation have been probably as constant as any of the laws of nature with which we are acquainted ". — This applies to one species — I would apply it not only to population & depopulation, but extermination & production of new forms. — this number & correlations |

4 Octob. 4th. [1838] It cannot be objected to my theory, that the amount of change within historical times has been small — because change in form is solely adaptation of whole of one race to some change of circumstances ; now we know how slowly & insensibly such changes are in progress — we feel interest in discovering a change of level of a few feet during the last two thousand years in Italy,[3] but what change would such a change produce in climate vegetation &c. — It is the circumstance of small physical changes & oscillations, not affecting organic forms, that the whole value of the geological chronology depends that most sublime discovery of the genius of man. |

5–14 *excised.*

15 sorts come up from it, lately saw a nonpareil sowed by Mr Tollet[4] so produce. — thinks it probable that great part of those varieties may be due to impregnation from other apple trees. — now seeds of crab produce crab, so that some effect from apple trees is produced. — Thinks probably experiment was never tried of separating apple tree entirely from all others & so my experiment of strawberry[5] not so absurd. —

16 Thinks that such variety as red cabbage | produced from passage from *many varieties*, & probably would take long before all the stain would be got out of it. — Now this is curiously different from primrose suddenly produce *cowslip*, one is tempted to think here some anomaly — I can fancy cowslip producing primrose return to old stock, but not primrose producing cowslip |

17 Uncle J.[6] says common belief that female plant impresses main features on offspring & male the lesser peculiarities, — brilliancy of inflorescence

Gardeners by chance sometimes graft pears on apples they will live. but not flourish — a medlar may be grafted on pear. Mountain-ash & white Thorn !

[1] Thomas Robert Malthus. *An Essay on the Principle of Population*, 6th edition, London 1826, vol. 1, especially book I, chapter 6 ; and book II, chapter 13.

[2] Thomas Robert Malthus. *Ibid.* vol. 1, p. 529. Malthus wrote " divine power " instead of " the deity ".

[3] The reference is to the submergence and re-emergence of Roman buildings at Pozzuoli described by Charles Lyell : *Principles of Geology*, London, vol. 1, 1830, pp. 449, ff.

[4] Mr. Tollet of Betley Hall, cattle breeder, *cf. Variation of Animals and Plants*, London 1868, vol. 2, p. 199.

[5] The reference to Darwin's experiments with strawberries has not been traced.

[6] John Hensleigh Allen of Cresselly.

Species not being observed to change is very great difficulty in thick strata, can only be explained by several strata being merely leaf.[1] if one river did form sediment in one spot, for many epochs such changes would be observed. — |

18 G. W. Earl's Eastern Seas, p. 206 — shot a monkey, ceased their cries, " many of them descending to examine their defunct companion ".[2] —

p. 229 Borneo — only animals he heard of pigs, small bears or badgers, deer, apes, baboons, monkey & an animal probably a tapir.[3] —

p. 233. dogs in Borneo brought probably by Chinese[4] " the breed[5] of the latter being the same as the fox-like animals which are met with near Canton ".[6] " Here as in all Malay countries, I noticed a peculiarity[7] |

19–22 *excised.*

23 Macleay[8] says it is nonsense to say take a tooth of any animal (as Toxodon) & say its relations, — if we know its congeners then we can. — Now on my theory this certainly can be accounted for, on any other it is the will of God. —

Octob. 16th. A very strong passage might be made — why seeing great variation in external form of varieties, do we suppose bones will not change in *number* (even *species* do not this), because it has been so pronounced ex cathedrā. Let us look at facts. considering few domestic animals few that have not.[9] cows hornless (horses not) |

24 If they give up infertility in largest sense as test of species, — they must deny species which is absurd. — Their only escape is that rule applies to *wild* animals only. from which plain inference might be drawn that whole infertility of hybrid receive no explanation was consequent on mind or instinct now this is directly incorrect.

The case of my mice[10] is good, because it is an involuntary variation made by man. common to every individual & therefore effect of climate. — |

25–30 *excised.*

31 Did *man* spread over world as early as Elephants &c. — if in next 20 years none of his remains found in the Americas probably did not. —

Octob. 25th. I observed in Windsor Park — the Fallow Deer which were of a nearly

[1] Darwin's meaning is that many of the individual strata are as thin as a leaf of a book and contain no fossils. It is an adaptation of Lyell's analogy between Geological formations and a book with most of its leaves torn out and lost.

[2] George Windsor Earl. *The Eastern Seas or Voyages and Adventures in the Indian Archipelago in* 1832–33–34, London 1837, p. 206. The author uses the word " comrade " instead of " companion " as quoted by Darwin.

[3] George Windsor Earl. *Ibid.* p. 229.

[4] The words " brought probably by Chinese " were crossed out by Darwin in the MS.

[5] In the MS. the word " being " is inserted here.

[6] George Windsor Earl. *Ibid.* p. 233.

[7] George Windsor Earl. *Ibid.* p. 233 : " Here ,as in all Malay countries I noticed a peculiarity in the cats, which I never heard satisfactorily accounted for. The joints near the tip of the tail are generally crooked, as if they had been broken ".

[8] William Sharp Macleay. Presumably personal communication. Darwin is contending that the relatives of a form can be identified by similarities in the structure of parts and that this can be accounted for on the theory of descent by modification from common ancestors.

[9] The word "not " is repeated here in the MS. after the word ". which " crossed out.

[10] " My mice ": *cf.* G. R. Waterhouse. " Species of the Genus Mus, forming part of the collection presented to this Society by Charles Darwin, Esq." *Proc. Zool. Soc. Lond.*, vol. 5, 1837, p. 15.

uniform blackish brown yet retained a trace of horizontal mark on flanks ; & tail & kind of semi-lunar mark[1] on each side darker, so that whole colour is changed. these best marked characters are partly retained, therefore colours vary in same manner as they would vary, if in wild state : thus mark on ear of cats be barred |

32 Ditto saw what was said to be hybrid between silver & gold fish.

Octob. 26th. If hereafter M[astodon] angustidens be found to be inhabitant of S. America & as it is embedded with almost recent shells. — shows that progression of change in Molluscs is somewhat similar in two hemispheres. — It might be worth investigating whether Megatherium & Mastodon are embedded in N. America. see my Journal[2] for references.

In such cases as at Galapagos where different islets have different forms it is either effects of having been long separated, or having never |

33–36 *excised.*

37 from its master. — dogs when strayed hang their tails. —

November 1st — Addenda to Journal.[3] I show erratic blocks transported far S. in Northern Hemisphere — likewise far North in Southern. — Great animals of same two great orders destroyed about same time in North & South America. — Whole world formerly possessed a climate compared to S. America at present days, which S. America now does to North America & Europe. — S. America favourable
38 to Tropical productions. | The world formerly much more so, yet climate of same order as that of S. America. — (Explained by profound views of Lyell)[4]

Now Equatorial America from the low limits of blocks both North & South, has probably undergone a greater change, than any parts, (except Europe in which all Tropical forms have been obliterated) of the world. from the Equable kind of |
39 climate to the extreme. — Therefore species which were filled from such a preeminently equable climate might not have been able to have survived a change, (& become transmuted), although other parallel species in other continents might have survived this mundine change. — Therefore I argue from this that Africa & East Indian Archipelago formerly were not so very *equable*, or so *tropical*, & therefore present
40 state of world is not so different, with | regard to their productions. — Hence it is, from the ancient preeminently equable & temperate climate of America, that the Mammalia of S. America are as different from the existing orders, as the Eocene of *Paris* ! (Great Edentates at that period) Analyse this, — consider state of |

41–42 *excised.*

43 If species change, we see external conditions have great effect on them, & therefore extermination becomes part of same law. —

When we know what a great effect light has in colouring plants, — who can say what colours acting by a most delicate organ, on the whole system may produce ?

[1] A small sketch here in MS.

[2] Charles Darwin. *Journal of Researches into the Geology and Natural History of the Various Countries visited by H.M.S. Beagle*, London 1839, p. 152.

[3] Charles Darwin. " Darwin's Journal ", *Bull. Brit. Mus.* (*Nat. Hist.*) Historical Series, vol. 2, 1959 p. 8 ; against the date October 27, 1838 is the entry : " Preface and addenda on Theory of Erratic Blocks to Journal [of Researches] ". *cf. Journal of Researches*, London 1839, p. 288.

[4] Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 1, p. 138.

When a species becomes rarer, as it progresses towards extermination, some of the species must increase in number where then is the gap, for the new one to enter? — |

44 The wonderful species of Galapagos must be owing to their islands having been purely results of *elevation*. — all modern & wholly volcanic — Azores might be prophesied to have this character. — Worth going there for. — Gales of wind would blend species.

Buckland[1] Reliquiae Diluvianae p. 222. Bones of Horse, Bear & Deer at 16000 feet

45 with snow on Himmalaya — Humboldt bones | at 7800 in Andes[2] — parallel & curious facts. — The Himmalaya case bears on the vast changes even in that quarter of the world. — Mem. elevation & subsidence of East Indian Archipelago now rising.

On a particular part of coast of Somersetshire the Cockles are all apt to be diseased & some of them asymmetrically, — it is easy to get 50 of same kind of monstrosities G. B. Sowerby.[3] — |

46 Looking over Lamarck[4] surprised to see how many Tropical genera come from New Holland. ?Sydney?

The dog being so much more intellectual than fox, wolf &c &c — is precisely analogous case to man exceeding monkeys. — |

47 Having proved mens & brutes bodies on one type : almost superfluous to consider minds. — as difference between mind of a dog & a porpoise was not thought overwhelming — yet I will not shirk difficulty — I have felt some difficulty in conceiving how inhabitant of Tierra del Fuego is to be connected with civilized man. — ask the Missionaries about Australian yet slow progress has done so. — Show a savage dog, & ask him how wolf was so changed. |

48 When discussing extinction of animals in Europe ; the forms themselves have been basis of argument of change. — now take greater area of water & snow-line descent. I do not wish to say only cause, but one great final cause, nothing probably exists for one cause. My theory gives great final cause of sexes in separate animals : for otherwise there would be as many species, as individuals, & though we may not trace out all the ill effects, — we see it is not the order in this perfect world, either |

49 at the present, or many anterior epochs. — but we can see if all species, there would not be social animals. hence not social instincts, which as I hope to show is probably the foundation of all that is most beautiful in the moral sentiments of the animated beings — &c. this[5] is stated too strongly. for there would be innumerable species & hence few only social there could not be one body of animals. life with certainly another

Whether he was or not He is [at] present a social animal. If man is *one* great object

[1] William Buckland. *Reliquiae Diluvianae or Observations on the Organic Remains in Caves, Fissures, and Diluvial Gravel, and other Geological Phenomena attesting the action of an Universal Deluge*, London London 1823, p. 222 : " But in Central Asia the bones of horses and deer have been found at an elevation of 16,000 feet above the sea, in the Hymalaya mountains . . . "

[2] William Buckland. *Ibid.* p. 222 : " we have in America the bones of the mastodon at an elevation of 7800 feet above the sea, in the Camp de Géants, near Santa Fe de Bagota ; and another species of the same genus in the Cordilleras, found by Humboldt, at the elevation of 7200 feet . . . "

[3] George Brettingham Sowerby. Possibly personal communication.

[4] Jean-Baptiste de Lamarck. *Genera of Shells*, translated by John George Children, n.p. 1823.

[5] The words from here to the end of the paragraph are inserted between lines, and the last four words are uncertain. Perhaps " purpose " was intended at the end.

for which the world was brought into present state, — a fact few will dispute, (although, that it was the sole object, I will dispute, when I hear from the geologist the history, from the astronomer that the moon probably is uninhabited) & if my theory be true then the formation of sexes rigidly necessary. — |

50 Without sexual crossing, there would be endless changes, & hence no feature would be deeply impressed on it, & hence there could not be *improvement*, & hence not in higher animals — it was absolutely necessary that Physical changes should act not on individuals, but on masses of individuals. — so that the changes should
51 be slow & bear relation to the whole changes of country, & not to the local | changes — this could only be effected by sexes. all the above should follow after discussion of crossing of individuals with respect to representative species, when going North & South.

Thinking of effects of my theory, laws probably will be discovered of corelation of parts,[1] from the laws of variation of one part affecting another. —

(I from looking at all facts as inducing towards law of transmutation, cannot
52 see the deductions which are possible.) — Ascertainment of | closest species (& naming them) with relation to habits, ranges & external conditions of country, most important & will be done to all countries, — but naming mere single specimens in skins worse than useless. — I may say all this, having myself aided in such sins. Yet there is no cure (do not add name without reference to description), except describers having some high theoretical interest, — " the great end must be the law & causes of change ". — A philosopher would as soon turn tailor as mere describer of species from its garments, without some end. — Respect good describers like Richardson.[2] |

53 The relations of numbers of species to genera &c &c can never be told without species being described. — but the permanent varieties in same country, must be distinguished from permanent varieties not in same country. —

The traces of changes in forms of organs, will care little for species, except so far as wanting names to refer to, to those forms, when the termination of change occurs. — Those discovering the *formal* laws of the corelation of parts in individuals, will care little, whether the individual be species or variety. but to discover *physical*
54 laws of such corelation, & changes of | individual organs, must know whether the individuals forms are permanent, all steps in the series, their relation to the external world, & every possible contingent circumstance. — The laws of variation of races, may be important in understanding laws of specific change. — When the laws of change are known — then primary forms may be speculated on, & laws of life, — the end of Natural History will be approximated to. —

Treating of the formal laws of corelation of parts & organs it may serve perfectly to |

55–56 *excised.*

[1] This reference to the correlation of parts shows that Darwin entertained it very early. As Professor S. Adler F.R.S., has suggested, it was probably because Darwin was over-impressed with the importance of this concept that he failed to think of the particulate nature of heredity.

[2] Sir John Richardson. Author of *Fauna Boreali-Americana ; or the Zoology of the northern parts of British America*, London 1829–1837.

57 The Pipe-fish is instance of part of the hermaphrodite structure being retained in the male,[1] — far more than marsupial bones, & even more than mammae, which have given milk. — is secretion from Pidgeon stomach true milk. — Species are innumerable variations[2]

Every structure is capable of innumerable variations. as long as each shall be *perfectly* adapted to circumstances of *times*, & from persisting owing to their slow formation these variations tend to accumulate on any structure. |

58 L'Institut[3] 1838, p. 384. List of fossil Mamm : from Poland &c. —

Three principles will account for all

(1) Grandchildren like grandfathers

(2) Tendency to small change especially with physical change

(3) Great fertility in proportion to support of parents |

59 December 2[d] Lyell[4] letter Mr Beck[5] considers the characteristics of the Tropical Forms in shells are numerous species, numerous individuals, & *species* of *large size*. — consider this (Cetacea) with reference to my theory.

Babbage[6] 2nd Edit. p. 226 — Herschel[7] calls the appearance of new species the mystery of mysteries, [8] & has grand passage upon the problem. ! Hurrah — " intermediate causes " |

60 The Sexual system of the Cirrhipedes is the more remarkable from their alliance to Articulata, which are all truly bisexual.

Buckland's[9] Reliqu : Diluv. says *Africa* only place where Elephant, Rhinoceros, Hippot., Hyaena & are found together. — Read this Work. —

Decb. 4[th] Why has the organization of fishes & Mollusca (& plants ???) been so little progressive (& insects. — Stonesfield[10] ???) ! Agassiz[11] makes it wonderfully *changed* since Cretaceous period. whether progressive I know not. Have Mammalia ?? my theory certainly requires progression, otherwise |

61–62 *excised.*

[1] The male pipe-fish carries the developing eggs in a ventral pouch.

[2] The words " species are innumerable variations " are crossed out in the MS.

[3] Carl Eduard von Eichwald. " Sur des Ossements fossiles de Mammifères trouvés en Pologne ", *L'Institut*, 1838, vol. 6, p. 384.

[4] Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 56.

[5] Henrich Henrichsen Beck.

[6] Charles Babbage. *The IXth Bridgewater Treatise. A fragment*, London 1837. On p. 226 of the 1st edition is an Appendix " On the age of strata as inferred from the rings of trees embedded in them ", the 2nd edition of this work has not been consulted.

[7] See Introduction, p. 157 above.

[8] Here is the origin of this expression on the first page of the Introduction of the *Origin of Species*.

[9] William Buckland. *Reliquiae Diluvianae ; or, Observations on the Organic Remains contained in Caves, Fissures, and Diluvial Gravel, and other Geological Phenomena attesting the action of an Universal Deluge*, London 1824, p. 170 : " . . . another interesting branch of inquiry connected with it is, whether any fossil remains of elephant, rhinoceros, hippopotamus, and hyaena exist in the diluvium of tropical climates; and if they do, whether they agree with the recent species of these genera, or with those existing species, whose remains are dispersed so largely over the temperate and frigid zones of the northern hemisphere." On p. 21 Buckland refers to the modern hyaena living in Africa, and the elephant, rhinoceros, and hippopotamus were well known to be African. The statement that Africa is the only continent in which they all lived has not been traced.

[10] The reference is to Mesozoic Mammals discovered in the Stonesfield Slate, published by William John Broderip, *Zool. Journ.* vol. 3, 1828, p. 408.

[11] Louis Agassiz. *Recherches sur les Poissons Fossiles*, Neuchâtel, 1833, tome 1, p. xxvii : " Les espèces de la craie appartiennent pour plus des deux tiers à des genres qui ont entièrement disparu." From " Agassiz " to " I know not " inserted between lines.

63 Are the feet of water-dogs at all more webbed than those of other dogs. — if nature had had the picking she would make such a variety far more easily than man, — though *man's practised* judgment even without time can do much. — (yet one cross, & the permanence of his breed is destroyed).

When two races of men meet, they act precisely like two species of animals. — they fight, eat each other, bring diseases to each other &c., but then comes the most
64 deadly struggle, namely which have | the best fitted organization, or instincts (i.e intellect in man) to gain the day. — In man chiefly intellect, in animals chiefly organization, though Cont. of Africa & West Indies shows organization in Black Race there gives the preponderance, intellect in Australia to the white. — The peculiar skulls of the men on the plains of Bolivia — study [?] fossil — & in Van Diemen's land — they have been exterminated on *principles* strictly applicable
65 to the | universe — The range of man is not unlike that of animals transported by floating ice. — I agree with Mr Lyell,[1] man is not an *intruder* — : the geological history of man is as perfect as the Elephant if some genus holding same relation as Mastodon to man were to be discovered.

Man acts & is acted on by the organic and inorganic agents of this earth like every other animal. |

66 Would anyone raise an argument against my theory, should no fossil very distinct species of the Ornithorhynchus be found; yet until man became cosmopolite, he would probably be confined in locality like Ornithorhynchus: since being cosmopolite, we do find his remains. — Lima — caves. — There being no fossils, the only way, that I can see to discover whether the parent of man was quadruped or bimanous,
67 is to see, what | parts of structure abortive. — Remember my fathers[2] remark about the Bladder. —

The numbers of fatal diseases in mankind, the more valuable domesticated animals no doubt is owing to the tearing up of every hereditary tendency towards fatal diseases, & such constitutions only being cleared off by fatal diseases. — |

68 The value of a group does not depend on the number of the species: therefore man & monkeys have equal chance that progenitor was bimanous or quadrumanous. — What a chance it has been, (with what attendant organization, Hand & throat)
69 that has made a man. — [3]any monkey probably might, with | such chances be made intellectual, but almost certainly not made into man. — It is one thing to prove that a thing has been so, & another to show how it came to be so. — I speak only of the former proposition. — as in races of Dogs, so in species & in man.

December 16th The end of each volume of Whewells[4] Induction History contains many most valuable references |

70 See if any law can be made out, that varieties are generally additions, & not abortive: with reference to the non-necessity of the so-called progressive tendency law. —

In animals analogy leads one to suppose that seminal fluid fluid (& not dry as in plants) therefore, great difficulty in crossing *& this most important obstacle to my*

[1] Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, pp. 68, 238.
[2] Robert Waring Darwin. The nature of the remark is unknown.
[3] A square bracket is opened here; it is not closed.
[4] William Whewell. *History of Inductive Sciences*, London 1837.

theory[1] without the hermaphrodites mutually couple. — now how is it in Planaria,
71 they couple (lowest terrestrial animals), — in shells? — | *insects* ? — all !??!? — Worms? Barnacles, aquatic Crustaceans, & true hermaphrodites [2] *It may be said that true hermaphroditism is a consequence of non-locomotion* — (contradicted by Plants) & as there are no fixed land animals, so there are [no] true hermaphrodites. — I suspect this rather effect of liquid semen, therefore animal life commenced in water!

It is a beautiful part of my theory, that domesticated races of organics are made by precisely same means as species — but latter far more perfectly & infinitely slower. — No domesticated animal is perfectly adapted to external conditions. — (hence great variation in each birth) from man arbitrarily destroying certain forms
72 & not others. — Term *variety* may be used to *gradation* of change | which gradation shows it to be the effect of a gradation in difference in external conditions, — as in plant up a mountain — In *races* the differences depend upon inheritance & in *species* are only ancient & perfectly adapted races

L'Institut[3] 1838, p. 394. Rhinoceros tichorhinus in Paris basin. — its relation to African Species good observations[4] larger than any living |

73–74 *excised.*

75 A Greyhound might be made almost without any relation to running hares as in Italian Greyhound[5] — not so species every part of newly acquired structure is fully practical & perfected. Hence difference between *race & variety* ?

Man picks the male, instead of allowing strength to get the day.

The fertility of Indian & Common Oxen, which one must think deserve the name of species, may be owing to the little fixity of organization, in the two races, owing to the domestication of both. — Now in the ass — there is little tendency to vary & hence offspring are hybrids. — |

76 Mr G. B. Sowerby[6] showed me many land shells of the common species from one locality all left whorled. — He kept two to see if they would breed.

It is difficult to think of *Plato & Socrates*, when discussing the Immortality of the Soul as the linear descendant of mammiferous animal, which would find its place in the Systema Naturae. |

77 Looking at simple generation as being the action of two organs in one body, — or in two bodies, we can as well understand the necessity of a relation between the fluids of the two as in the grafting of trees. Mr. Knight[7] makes this analogy between grafting & sexual union. — [8]The similarity of child to parent appears to follow same

[1] The words in italics enclosed between square brackets.
[2] From " Barnacles " to " hermaphrodites " enclosed between square brackets.
[3] " M. Valenciennes écrit qu'en faisant des fouilles sur la Place de la Grève pour les fondations des nouveaux Bâtiments de l'Hôtel de Ville, on a trouvé à 17 pieds au-dessous du sol, un humérus droit de Rhinocéros de l'espèce nommée par Cuvier *Rhinoceros tichorhinus*." *L' Institut*, 1838, tome 6, p. 394.
[4] The words " good observations " were crossed out in the MS.
[5] " as in Italian greyhound " inserted in pencil.
[6] George Brettingham Sowerby. This was a century before the experiments were performed by A. E. Boycott, C. Diver, S. L. Garstang, and F. M. Turner : " The inheritance of Sinistrality in Limnaea peregra ", *Phil. Trans. Roy. Soc.*, B, vol. 219, 1930, p. 51.
[7] Thomas Andrew Knight. " Introductory Remarks relative to the objects which the Horticultural Society have in view ", *Trans. Hort. Soc.*, vol. 1, 1820, (read 2 April 1805). On p. 4 : " to use the phrase of Lord Bacon, the graft in all cases overruleth the stock, from which it receives *aliment, but no motion.*"
[8] A square bracket is opened here ; it is not closed.

law in two of the *same* variety, as in two *varieties*, & this we might expect, as the difference between man & woman is indeed (independent of sexual differences)
78 a *variety*. The offspring of true | hermaphrodite would of course be like either, that is both parents, for they are one. —

The laws, therefore, of likenesses of fathers to children of mankind no doubt are applicable to likenesses, when species & races are crossed. — Now these laws are, that child may be either like father or mother, independently of its sex, or half way between, or someway different from either : or like progenitors. — in some families all the children like mother & in some like father What is cause of this. — |
79 (Lord Mortons [1]law holds with *difierent species*, & individuals of *same species*. —) some races of man D'Orbigny[2] affect the common progeny more than others. — does this more refer to length of time that the resemblance is permanent, or the similarity at first births. — it is the latter only that one refers to in speaking of resemblances of children to their parents. —

Lord Morton's law[3] cannot hold with fishes, & there are mule fishes & reptiles & those which have their eggs impregnated externally ; nor can it be a *necessary* concomitant with moths which can be impregnated externally. |
80 My view of every animal being Hermaphrodite — probably will receive illustration from domestication of Monoecious plants & abortion of others. —

? in hemi-hermaphrodite insects is it not easier to understand ?*perfect* ?? developement of one sex on one side, then the addition of other organs, in which case the hermaphroditism would not be perfect. in Ox the amount of double sexual developement is spread over |
81–82 *excised.*
83 is utterly untold, — what is added to the composition of the atom to make it alive, & how the laws of generation were impressed on it. —

Seeing that all vertebrates Müller's[4] Physiolog. p. 24 can be traced to a germ, endowed with the vital principle, which gives rise to the sexual organs, different in each species, — & knowing from analogy, that all these big animals are descended from some one single stock, one is led to suspect that the birth of the species & individual
84 in their present forms, are closely related — By birth the | [5]successive modifications of structure being added to the germ, at a time (as even in childhood) when the organization is pliable, such modifications become as much fixed, as if added to old individuals during thousands of centuries, — each of us then is as old as the oldest animal,[6] have passed through as many changes as has every species. — |

[1] Lord Morton. " A communication of a singular fact in Natural History ", *Phil.Trans. Roy. Soc.* vol. 111, 1821, p. 20'. Lord Morton's " law " is the supposed transmission through the dam to the progeny of characters of another sire which the dam does not possess.

[2] Alcide Dessalines d'Orbigny. " L'homme américain (de l'Amérique méridionale), considéré sous les rapports physiologiques et moraux ". *Comptes rendus Acad. Sci.*, Paris, tome 7, 1838, p. 568.

[3] Lord Morton's " law " could not be expected to hold in cases where the young undergo development externally to the mother as free and independent larvae.

[4] Johannes Müller. *Elements of Physiology*, translated from the German by William Baly, London 1839, vol. 1, p. 24 : — " organic beings do not subsist merely by virtue of accidental combination of elements; but, on the contrary, by the vital force inherent in them . . . The germ is " potentially " the whole animal." This reference is enclosed between square brackets.

[5] The word " the " is repeated here.

[6] The words " is as old as the oldest animal " were crossed out by Darwin in MS. This is an early attempt by Darwin to express anatomy in terms of embryology.

85–88 *excised.*

89 Jan. 6th [1839] The rudiment of a *tail* shows man was originally *quadruped.* Hairy — could move his ears

The head being six metamorphosed vertebra,[1] the parents of all vertebrate animals must have been like some molluscous bisexual animal with a vertebra only & no head— !!

Handwriting is determined by most complicated circumstances, as shown by difficulty in forging. yet handwriting said to be hereditary, shows well what minute details of structure of [*recte* are] hereditary |

90 Athenaeum[2] 1839, p. 36. — a crustaceous animal is mentioned which inhabits the Pinna of Rio Janeiro (like some Mediterranean species). — might these fertilise other shells, as insects do flowers. — Mem. Spallanzanis[3] experiments showing how little of the spermatic fluid fertilized spawn of frogs. —

Annals of Natural History[4] (p. 225, 1838) account of metamorphosis in the young of Syngnathus. curious as showing generality of law even in fish : ditto p. 236 on Hybridity in ferns.[5] — ditto p. 250 — speaking of the terrestrial mollusca of Morocco, Mr Forbes[6] says the Fauna (near Oran) approach in character to Canary Isld. — i.e. Canary Isld approaches *more* to neighbouring coast of Africa, than to other parts of that |

91–94 *excised.*

95 The enormous *number* of animals in the world depends of their varied structure & complexity. — hence as the forms became complicated, they opened *fresh* means of adding to their complexity. — but yet there is no *necessary* tendency in the simple animals to become complicated although all perhaps will have done so from the new relations caused by the advancing complexity of others. — It may be said, why should there not be at any time as many species tending to dis-developement (some probably always have done so, as the simplest fish), my answer is because, if we begin with the simplest forms & suppose them to have changed, their very changes
96 tend to | give rise to others. — Why then has there been a retrograde movement in Cephalopods & fish & reptiles? — supposing such be the case, it proves the law of

[1] When Darwin wrote, the accepted view was that of Goethe and Oken that the vertebrate skull was composed of a number of fused vertebrae. This relic of transcendental anatomy, to which Richard Owen also subscribed, was destroyed by T. H. Huxley in 1858 (G. R. de Beer, *The Development of the Vertebrate Skull*, Oxford 1937).

[2] *Athenaeum*, 1839, 12th January, p. 36. Miscellanea. *New Crustacea.* " A surgeon of the French navy, M. Mittre, just arrived at Brest, among several new and interesting objects of natural history, has brought a new Maclura, which he found at Rio de Janeiro in the Pinna nobilis. The existence of this Crustacean in the seas of the New World is a curious fact in the geography of zoology, for since the time of Aristotle, it has only been found in the Mediterranean."

[3] Lazzaro Spallanzani. *An Essay on Animal Reproduction*, London 1769. " Of the existence of the tadpoles in eggs before fecundation ". On page 46 : " . . . could not the eggs of frogs be fecundated artificially, by sprinkling them before fecundation, with the liquor extracted from the spermatic vessels of the male? ".

[4] B. F. Fries. " Metamorphosis observed in Syngnathus lumbriciformis ", *Ann. Nat. Hist.*, vol. 2, 1838, p. 225 : " . . . the young of this beautiful species at their development from the egg have the entire tail covered with a fin-like membrane and possess pectoral fins. These at a subsequent unknown period are thrown off in a way similar to that of the larvae of frogs rejecting their tails."

[5] M. Martens. " Hybridity in Ferns ", *Ann. Nat. Hist.*, vol. 2, 1838, p. 236 : M. Martens observed in the Botanical Garden of Louvain, a fern which he regarded as a hybrid between *Gymnogramma calomelanos* and *G. chrysophylla* ".

[6] Edward Forbes. " On the Land and Freshwater Mollusca of Algiers and Bougia ", *Ann. Nat. Hist.*, 1838, vol. 2, p. 250 : " Oran (near Morocco), where the Fauna of Barbary assumes a different aspect, approximating to that of the Canaries on the one hand, and to that of Spain on the other."

developement in partial [*recte* ? particular] classes is far from true. — I doubt not if the simplest animals could be destroyed, the more highly organized would soon be disorganized to fill their places. —

The geologico-geographico changes must tend sometimes to augment & sometimes to simplify structures. Without enormous complexity, it is impossible to cover *whole* surface of world with life. — for otherwise a frost if killing the vegetables in one quarter of the world would kill all, — & the one herbivorous & its one carnivorous
97 devourer ; it is | quite clear that a large part of the complexity of structure is adaptation, though perhaps difference between jaguar & tiger may not be so. — Considering the Kingdom of nature as it now is, it would not be possible to simplify the organization of the different beings, (all fishes to the state of the Ammocoetus, Crustacea to —? &c) without reducing the number of living beings — but there is the strongest possible [tendency?] to increase them, hence the degree of developement is either stationary or more probably increases. — |

98 Jan. 29th. Uncle John[1] says he feels sure, that the reason people send for their seeds to London is that people in the southern Counties have whole fields, some for cauliflower &c. — Uncle John believes one single turnip in a garden is sufficient to spoil a bed of Cauliflowers. — (How curious it would be to make enquiries of some of the great seed-growers —). —

Feb. 24th. Monoceros, which Sowerby[2] says is an American form, has several
99 species in my | fossils —[3] If cases of one variety in upper part of bed & another in lower is very rare, the conclusion will be that our greatest formations have been deposited in a period (say 10.000 years) which is sufficient only to have most slightly modified organic forms. — We know not rate of deposition has been equal even in one bed, much less in alternating strata of sand & limestone &c. &c. — |

100 L'Institut 1838,[4] p. 290 — admirable paper on geographical distribution of Crustacea. — (I forget whether I have already referred to it — also on spermatic animalcules in Musci frondosi, et hepatici, — in Chara, in Marchantia & Hypnum. —

Prof : Don[5] would have known the Composites of Galapagos were South American. — several cases of species peculiar to separate islets. —

March 5th. Lyell[6] says fossil shells from North America, Scotland, Uddevalla many species same. & northern forms — & the American ones & European — agree
101 very much | closer, than the present ones, which according to Beck[7] are different. — Subsidence of Greenland — case of splitting of two regions — are there any cases of union of two regions in modern times. — this would depend on negative evidence of fossil remains, & therefore not to be trusted. — Lyell tells me, on authoritiy of Beck that Hooded crow & Carrion crow have in Europe different ranges — latter not going |

[1] John Hensleigh Allen of Cresselly (1769–1843).

[2] George Brettingham Sowerby. *The Zoology of Captain Beechey's Voyage*, London 1839, p. 161 : " Monoceros crassilabrum Lam.; recent at Valparaiso, &c. Monoceros crassilabrum var.; recent at Valparaiso &c ". This note is not by Sowerby, but is included in the Section immediately following his " Observations by the Editor ".

[3] A square bracket is opened here : it is not closed.

[4] Henri Milne Edwards. " Géographie Zoologique. M. Milne Edwards lit l'extrait d'un mémoire sur la distribution géographique des Crustacés ", *L'Institut*, tome 6, 1838, p. 290.

[5] George Don (jun.) had collected plants in S. America.

[6] Charles Lyell. Presumably personal communication.

[7] Henrich Henrichsen Beck. Personal communication to Lyell.

102 north of the Elbe, — yet they meet in one wood in Anhault & there every year produce hybrids — now this is independent good case, but very odd since these crows are mixed in England — for I presume Carrion Crow is found in Edinburgh. — Why does Fleming[1] consider them varieties & what says Jenyns[2] to it? — In argument of origin of Wolf, difference of mind is most relied on, |

103–104 *excised.*

105 forms. — on southern flanks of Alps, many peculiar plants on single mountains, though these are connected with other mountains laterally. —

Owen.[3] Fossil Mammalia p. 55 talks of *Tapirus* American form found in Eocene beds of Paris.

Lyell[4] has remarked species never reappear when once extinct. Lyell's argument about Isl[d]. neighbours, formed in the Tertiary epoch like Sicily,[5] not having species, if true, important on my view. — |

106 March 9[th] Is there any relation between the fact that different species produce abundantly infertile hybrids, & the fact that old varieties do not so much affect first race, as it does indelibly the many subsequent ones.

My views,[6] V. p. 103 would lead me to think that a variety of one species would cross easier with 2nd species, than two perfect species ; but facts of grouse, & pheasant, & hooded crow goes against this, & *wild* hybrid plants. |

107 If many wild animals were crossed, there would probably be perfect series, from physical impossibility to unite to perfect prolifickness — (a series might be obtained)[7] but the intervention of domesticated i.e. new varieties destroys the appearance of this series & makes me think that one large body of varieties are fertile & make mongrel, & other great series quite otherwise & make no *true* hybrids — but this is false, give instance of series from wild animals & plants[8] |

108 Mr. Mark[9] has some nephews who are *astonishingly* like to some distant cousins, the nearest blood being a *great great* grandfather. — Little Miss Hibbert case of kindness coming out more than in mother or indeed grandmother : what is in S.S. parentage? —

[1] John Fleming. *A History of British Animals*, Edinburgh 1828, p. 87 : " Corvus corone . . . is this species different from the Hooded Crow ?"

[2] Leonard Jenyns. *A Manual of British Vertebrate Animals* Cambridge 1835. On pp. 145 and 146 *Corvus corone* the Carrion Crow and *C. cornix*, the Hooded Crow are listed as separate species.

[3] Richard Owen. *The Zoology of the Voyage of the Beagle*, Part I, Fossil Mammalia, London 1840, p. 55 : " It is well known how unlooked-for and unlikely was the announcement of the existence of an extinct quadruped entombed in the Paris Basin, whose closest affinities were to a genus, (*Tapirus*) at that time, regarded as exclusively South American."

[4] Charles Lyell. It seems that Darwin must have obtained verbally from Lyell the view expressed subsequently in his *Elements of Geology*, 2nd edition, London 1841, vol. 1, p. 200 : " It appears, that from the remotest periods there has been ever a coming in of new organic forms, and an extinction of those which pre-existed on the earth ; some species have endured for longer, others for a shorter time ; while none have ever re-appeared after once dying out."

[5] Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 444 : " We have seen that a large portion of Sicily has been converted from sea to land since the Mediterranean was peopled with the living species of Cetacea and zoophytes. The newly emerged surface, therefore, must, during this modern zoological epoch, have been inhabited for the first time by the terrestrial plants and animals which now abound in Sicily." The words " formed " to " Sicily " are in pencil.

[6] The reference is to MS. page 103 of this Notebook, which Darwin excised.

[7] The words " a series might be obtained " were crossed out by Darwin.

[8] The words " give " to " plants " enclosed between square brackets.

[9] Mr. Mark. Dr. Robert Darwin's coachman at Shrewsbury.

Wonderful as is the possession of voice by Man we should remember, that even birds can imitate the sounds surprisingly well. —

In early stages of transmutations, the relations of animals & plants to each other would rapidly increase, & hence number of forms, once formed, would remain
109 stationary, hence all present types are ancient | according to my views of *all* plants, being occasionally dioecious ; & really dioecious plants being effect of abortion of one sex. — Linnean class Dioecia & Monoecia ought to be preeminently artificial. —

Would not subsidence of Greenland render climate less extreme (& so account for descent [*recte* ascent] of snow line there & then & there only : as stated by Capt. Graah)[1] & break up N. American Conchology from European, & the climate being now less extreme than before, arctic forms would retreat : effect on snow of arctic climate in far north regions ? Arctic forms have travelled S. |

110 From the analogy of the animal kingdom I should suppose, — that the pollen of crab would POSSIBLY (no, for pollen of any kind would fertilize it)[2] fertilize an apple somewhat more readily than other apples, he probably would more indelibly stain offspring — it would not *reach* one apple sooner than that of another apple. only effect produced would be different. — same way one variety of dog does not prefer other, but produces greater effect on offspring — |

111 Mr. Herbert[3] says p 347 Amaryllidaceae Plants do not become acclimatized by crossing, or by *accidental production of seedling with hardier constitution.* — Now Sir J. Banks[4] says Zizania in 16 generatiǫns did become acclimatized, & says Laurels have not been so (which is case adduced by Herbert)[5] because not reared by seedlings. Now my principle does not apply to any plant reared artificially, & only very partially to the Zizanias in Sir J. ponds — my principle being the destruction of all the less
112 hardy ones & the | preservation of *accidental* hardy seedlings : (which are confessed to by Herbert)[6] to sift out the weaker ones : there ought to be no weeding or encouragement, but a vigorous battle between strong & weak.

[1] Captain Graah ; in Charles Lyell's *Principles of Geology*, 5th edition, London 1837, vol. 2, p. 302 : " The observations alluded to were made by Captain Graah during a survey of Greenland in 1823–24 ; and afterwards in 1828–29."

[2] The words in this bracket inserted subsequently.

[3] William Herbert. *Amaryllidaceae*, London 1837, p. 347 : " it does not appear that in reality any plant becomes acclimated under our observation, except by crossing with a hardier variety, or by the accidental alteration of constitution in some particular seedling." It will be noticed that Darwin's note on this passage is inaccurate by substituting " or " for " except ".

[4] Sir Joseph Banks. " Some hints respecting the proper mode of inuring tender plants to our climate," (read December 3rd, 1805), *Trans. Hort. Soc.*, vol. 1, 1811, p. 21. On p. 22 : " In the year 1791, some seeds of Zizania aquatica were procured from Canada, and sown in a pond at Spring Grove, near Hounslow; it grew, and produced strong plants, which ripened their seeds : these seeds vegetated in the succeeding spring, but the plants they produced were weak, slender, not half so tall as those of the first generation, and grew in the shallowest water only ; the seeds of these plants produced others next year, sensibly stronger than their parents of the second year. In this manner the plants proceeded, springing up every year from the seeds of the proceeding one, every year becoming stronger and larger, and rising from deeper parts of the pond, till the last year, 1804, when several of the plants were six feet in height, ... Here we have an experiment which proves, that an annual plant, scarce able to endure the ungenial summer of England, has become in fourteen generations, as strong and as vigorous as our indigenous plants are, and as perfect in all its parts as in its native climate."

[5] William Herbert. *op. cit.* p. 347 : " although we are told that laurels were at first kept in hothouses in this country, it was not that they were less capable of supporting our seasons than at present, but that the cultivators had not made full trial of their powers of endurance."

[6] William Herbert. *op. cit.* p. 347 ; see above.

March 11th. Yarrell's[1] law must be partly true, as enunciated by him to me, for otherwise breeders who only care for first generations, as in horses, would not care so much about breed. — what can however be more striking, about indelibleness,
113 than the | number of good race-horses which *Eclipse*? has begotten. Walker[2] attributes this to effect of male sex on locomotive system.

I am bound to insist honestly that the *sudden* change from Primrose to cowslip is great difficulty (I should doubt if wild species ever found like short-tailed cat or dog has been without recurrent tendency in external conditions) sudden loosing [losing] of horns. — I do not believe this nature's plan. —

Whether we can or not trace history of first appearance of varieties of domesticated animals, yet as we know how many plants have been produced (look at the Dahlias we may infer it in animals) — Azara[3] gives account of production of hornless cattle, ? & others? — |

114 March 12th. It is difficult to believe in the dreadful but quiet war of organic beings going on [in] the peaceful woods & smiling fields. — we must recollect the multitude of plants introduced into our gardens (opportunities of escape for foreign buds & insects) which are propagated with very little care, — & which might spread themselves as well as our wild plants, we see how full nature, how finely each holds its place. — When we hear from authors (Ramond[4] Hort. Tranact. vol. 1, p. 17 Append) that in the Pyrenees that the |

115–116 *excised.*

117 Poet Cowper[5] describes his tame Hares attacking a sick one like Chillingham bulls are described. — His three have had VERY different dispositions: this is important as showing small variations in offspring of wild animals — *grateful* & intelligent. —

The theory that all animals have sprung from few stocks, does not bear the least on ancient generic forms. — the animals in Eocene period could not have been direct parents of any of ours, — even if extinction is denied. — it will not account for all species even if it will for all [?*recte* some]. — |

118 Varieties are made in two ways — local varieties when whole mass of species are subjected to same influence, & this would take place from changing country: but greyhound race-horse & poulter Pidgeon have not been thus produced, but by

[1] William Yarrell who believed that in a cross the oldest variety had the greatest influence on the characters of the mongrel offspring. *cf.* Darwin's Second Notebook on Transmutation of Species, MS. pp. 1 and 121.

[2] Alexander Walker. *Intermarriage*, London 1838, " by regulating the relative youth, vigour and voluntary power of sire and dam, either may be made to give to progeny the voluntary and locomotive systems, and the other the sensitive and vital systems; though, if they be well conformed, it is preferable that the sire should give the former and the dam the latter, as being the systems in which naturally they respectively excel."

[3] Félix d'Azara. *Essais sur l'histoire naturelle des quadrupèdes de la province du Paraguay.* Paris ix (1801), tome 2, p. 371 : " Dans le district des Corrientes, naquit en 1770 un Taureau écorné ou sans cornes. Il a propagé sa race dans ces pays-ci, et il faut observer à cet égard que les petits d'un Taureau sans cornes en sont privés, quoique la mère ait des cornes, et que les petits d'un père à cornes en ont aussi, quoique la mère en soit privée."

[4] Louis-Elizabeth Ramond de Carbonnières. " On the vegetation of high mountains ", translated by Richard Anthony Salisbury (read 2nd April, 1811), *Trans. Hort. Soc.*, vol. 1, 1812, Appendix p. 15. The passage in question on p. 17 reads : " Thus in the Swiss Alps, and Pyrenees, trees cease to grow at about 2400 or 2500 metres of actual elevation, as they do about the 70th degree of north latitude."

[5] William Cowper. " Unnoticed properties of that little animal the hare ". *Gentleman's Magazine*, vol. 54, part I, 1784, p. 412. On p. 413 : " like many other wild animals, they persecute one of their own species that is sick." Their names were " Puss ", " Tiney ", and " Bess ".

training, & crossing & keeping breed pure — & so in plants *effectually* the offspring are picked & not allowed to cross. — Has nature any process analogous — if so she can produce great ends — But how — even if placed on Isl[d]. if &c &c — make the difficulty apparent by cross-questioning[1] — Here give my theory. — excellently true theory |

119–126 *excised.*

127 be thus put, shall we give up whole system of transmut. or believe that time has been much greater, & that systems are only leaves of whole *volumes*. —

The fact of tumbling pidgeons, — flying high all together & then tumbling far more wonderful than hereditary *ambling* horses.

Whether the body of parent be altered, that in the Nisus formativus (what does Muller[2] call it) succeeds in altering form of body, or whether it merely has tendency (as effects of cultivation or successive generations of plants) to do so, the effects are equally handed to offspring. — |

128 Whewell's[3] anniversary address 1839, p. 9 talks about fossil Infusoria becoming extinct not so soon as other forms. — p. 36 speaking about the controversy on Didelphys says[4] " If we cannot reason from the analogies of the existing to the events of the past world, we have no foundation for our Science".[5]— but experience has shown we can & that analogy is sure guide & my theory explains why it is sure guide. — |

129–132 *excised.*

133 the stigma retains its power. —

R. Brown[6] found the masses of pollen of Asclepias placed on Orchis (so very different) that the granules exserted their tubes ; now Mr. Herbert[7] has shown that stigma swells, when pollen even most remote is put to it. —

April 6[th] " Dr Edwards[8] on the Influence of Physical agents " translated by Dr

[1] These seven words inserted between lines.

[2] Johannes Müller. *Elements of Physiology*, translated from the German by William Baty, London 1839, 2nd edition, on p. 395 : " . . . both organs and nerves are produced by the same power, the nisus formativus, which resides undivided in the germ."

[3] William Whewell. " Address to the Geological Society, delivered at the Anniversary, on the 15th of February, 1839 ", *Proc. Geol. Soc. Lond.*, vol. 3, 1839, p. 61. On p. 63 ; " Of about eighty species of fossil Infusoria which have been discovered in various strata, almost the half are species which still exist in the waters : and thus these forms of life, so long overlooked as invisible specks of brute matter, have a constancy and durability through the revolutions of the earth's surface which is denied to animals of a more conspicuous size and organization." The page references given by Darwin must refer to the pagination of a reprint.

[4] William Whewell. *Ibid.* vol. 3, p. 89.

[5] While most of the credit for impressing Darwin with the principle of uniformity is rightly given to Lyell, this statement of Whewell's views should not be overlooked.

[6] Robert Brown. " On the organs and mode of fecundation in Orchideae and Asclepiadeae ", *Trans. Linn. Soc. Lond.*, vol. 16, 1833, p. 685. On page 728 : " Pollen masses of *Asclepias purpurescens* being applied to the stigma of *Epipactis palustris*, and immersed in its viscid secretion, the dehiscence, contrary to expectation, not only took place, but even more speedily than usual, that is within twenty-four hours. Some of the grains were also found discharged from the mass unchanged, while others, both discharged and still inclosed, had begun to produce tubes."

[7] William Herbert. " On the Production of Hybrid Vegetables ; with the Result of many Experiments made in the Investigation of the Subject ", *Trans. Hort. Soc.*, vol. 4, 1832, p. 15. On page 24 : " I touched its [Azalea] stigma therefore with the dust of Rhododendron Catawbiense. The capsules swelled, . . . "

[8] William Francis Edwards. *On the Influence of Physical Agents*, translated by Hodgkin, p. 54. This translation has not been accessible, but in the original work, *De l'influence des agens physiques sur la vie*, Paris 1824, the passage in question is on page 111 : " M. Cuvier, qui a fait de belles recherches sur ces animaux, a constaté que l'axolotl avait la structure d'une larve de salamandre ; que la sirène et le protée devaient constituer des espèces de genres différens, et que les poumons de ce dernier étaient dans un état presque rudimentaire."

Hodgkin p. 54 The axolotl, siren & Proteus, affinity to tadpoles, p. 210, shows[1] that the action of light is concerned with the developement of form; but that tadpole
134 increased in size. — | Now the Proteus anguiformis he remarks lives in dark caverns of Carniola

p. 112. Man[2] " standing alone in the gift of intellect, he resembles other mammalia in the effects produced on organization by *physical agents*."

p. 466. Many facts given of high temperature at which fish &c can live.[3] —

Lyell[4] says that naked cuttle fish now bear a very large proportion to other mollusca
135 in cold parts of sea, like Cetacea, although the | Cephalopoda seem to have decreased since earliest times —

Apterix has a most perfect Struthio head pulled out, yet feathers retain character? If separation in horizontal direction is far more efficient in making species, then time, (as cause of change) which can hardly be believed, then, uniformity in geological formation intelligible.

No, but the wandering & separation of a few probably would be most efficient in producing new species: also one being reduced in numbers, but not so much then, because circumstances.[5] |

136 Cestracion. Port Jackson shark. Owen[6] thinks Australia part of old World.

It may be said that wild animals will vary according to my Malthusian views, within certain limits, but beyond them not, — argue against this — analogy will certainly allow variation as much as the difference between species, — for instance pidgeons — : then comes question of genera. It certainly appears that swallows have decreased in numbers, what cause ?? |

137 Seeing the beautiful seed of a Bull Rush I thought, surely no " fortuitous " growth could have produced these innumerable seeds, yet if a seed were produced with infinitesimal advantage it would have better chance of being propagated & so &c. The greatest difficulty to my theory, is same type of shells in oldest formations: — The Cambrian formations do not however, extend round world. Quartz of Falkland. — Old Red Sandstone — Van Diemen's land — Porphyries of Andes. — |

138 A familiar history of birds by the Rev. E. Stanley[7] vol. 1, p. 72. — Goldfinches placed near, but not in sight of each other will sing till they drop off their perch. —

p. 101 — Kingfisher in northern parts of England stationary, in southern stays only winter. — Jays & chaffinches sometimes migratory.[8]

[1] William Francis Edwards. *Ibid.* p. 400: " Ainsi ces deux séries d'expériences concourent à prouver que la présence de la lumière solaire favorise le développement de la forme, et servent à faire distinguer ce genre de croissance de celui qui consiste dans l'augmentation des dimensions générales du corps."

[2] William Francis Edwards. *Ibid.* p. 230: " Unique par son intelligence, il se rapproche des mammifères par les nécessités de la vie, communes à tous les êtres qui ont une organisation semblable."

[3] William Francis Edwards. *Ibid.* p. 601: " Tableau de l'influence de la température sur la vie des poissons . . . " *et seq.*

[4] Charles Lyell. Presumably personal communication.

[5] This paragraph inserted at the bottom of the page.

[6] Richard Owen. Presumably personal communication.

[7] Edward Stanley. *A Familiar History of Birds*, London 1814, vol. 1 p. 72: " Goldfinches . . . are put in small cages, with wooden backs, and placed near to, but so that they cannot see, each other: they will then raise their shrill voices, and continue their vocal contest till one frequently drops off its perch, perfectly exhausted. . . . "

[8] Edward Stanley. *Ibid.* p. 101: " . . . the Kingfisher, which in the northern parts of England may be seen all the year round, on some parts of the southern coasts only makes its appearance in October in considerable numbers, and as regularly departs in the following spring. Few would suspect our constant and lively companions, the Jays and Chaffinches to be at times travellers, but so it is; there is proof of the fact."

p. 103. Turtles finding their way to the Caymans from Honduras good case of migrating shows my theory insufficient.[1] —

p. 120. An Eagle is said to have been seen carrying a lamb two miles towards the Morne mountains, it[2] |

139–140 *excised.*

141 May 4th The Brussels Sprout returning suddenly to type when brought back to home (& yet all the varieties of Brassica certainly not becoming Brussels Sprouts) & yet in all probability the Brussels Sprout was slowly formed, — is analogous to Primrose & Cowslip *suddenly* changing into each other, & depends on character of antecedent races. —

if it shall be difficult to show that the fixity of characters from antiquity prevents their variation, which is not improbable as Mr. Herbert[3] does not seem to recognize any difference in crossing between varieties & species, yet the amount of [*blank*] |

142 may depend on many circumstances, time of domestication (see Wi[l]kinson[4] on dogs of Egypt & Cuvier[5] on mummies).

NB Time *is element* in change, as in *Dahlias*[6] all much varied breeds both plants & animals have long been subject to domestication. — The constitution of some may resist the means man can offer of changes, — as desert or rock plant probably would do — or be with difficulty be kept alive. — Nevertheless much probably depends on circumstances favouring the reappearance of characters formerly possessed or rather the parents having passed through many changes. — |

143 It is very important Mr Herbert's[7] fact about the hybrids (mentioned in letter to Henslow) fertilizing each other, better than the pollen of same flower, — as it tends to show my view of infertility[8] of hybrids with parent species false, which makes it determined by a facility in returning to old type.

Mr Herbert[9] showing the extreme facility of crossing in plants proves how much depends on instincts in animals. — yet the existence of wild close species of plants

[1] Edward Stanley. *Ibid.* p. 103: " ... it has been observed in turtles, which cross the ocean, from the Bay of Honduras to the Cayman Isles, near Jamaica, a distance of 450 miles, without the aid of chart or compass, and with an accuracy superior to human skill; for it is affirmed, that vessels which have lost their reckoning in hazy weather, have steered entirely by the noise of the turtles in swimming."

[2] Edward Stanley. *Ibid.* p. 120: " ... in Ireland a large Eagle was seen to alight and take up a lamb, and carry it away in a straight direction towards the high range of the Morne mountains."

[3] William Herbert. *Amaryllidaceae*, London 1837, p. 17: " It seems to me utter waste of words to argue whether vegetables, if of one genus or identical kind, are species or varieties." p. 341; " In fact there is no real or natural line of difference between species and permanent or descendible variety."

[4] John Gardner Wilkinson. *Manners and Customs of the ancient Egyptians*, London 1837, vol. 3, p. 32.

[5] Georges Cuvier. " Sur l'Ibis des anciens Egyptiens ", *Annales du Muséum national d'Histoire Naturelle*, tome 4, an XII (1804), p. 116. On page 118: " J'ai partagé l'erreur des hommes célèbres que je viens de nommer, jusqu'au moment où j'ai pu examiner par moi-même quelques momies d'ibis."

[6] From " NB " to " *Dahlias* " enclosed between square brackets.

[7] William Herbert. *cf. Amaryllidaceae*, London 1837, p. 342: " Subsequent experiments have confirmed this view to such a degree as to make it almost certain that the fertility of the hybrid or mixed offspring depends more upon the constitutional than the closer botanical affinities of the parents."

[8] The initial *i* of " infertility " is crossed out.

[9] William Herbert. " On the production of Hybrid Vegetables; with the result of many Experiments made in the Investigation of the Subject ", *Trans. Hort. Soc.*, vol. 4, 1832, p. 15: " ... I am, however, satisfied, from the progress I have already made, that several plants, which I have raised, are not only, in the fair sense of the word, hybrid, but also fertile; and if they should perpetuate themselves by seed, without reverting to the form of either parent, they will be entitled to be considered by the Botanists as distinct species. ... and I doubt very much whether such a multiplication of distinct species may not also have taken place in the animal and insect tribes; but, to produce an intermixture between species that may have so diverged, the will of the animal must consent, while that of the plant need not be consulted."

144 shows there is tendency to prevent the crossing. — | in animals where there is much facility in crossing there comes the impediment of instinct —

The possibility of rearing by seeds holyoaks[1] (how far is this so) shows either there is not so much crossing as I think, or that these varieties have become as fixed as species, & prefer their own pollen to that of other variety. —

Elizabeth[2] & Hensleigh[3] seemed to think it absurd that the presence of the Leopard & Tiger together depended on some nice qualifications each possess, & that tiger springing so much further would determine his preservation — if killed by some other animal then that quality which saved him, would be the one encouraged. — |

145 Wilkinson's[4] Manners & Customs of the Ancient Egyptians vol. III p. 33 — They have several breeds of dogs — like greyhound — fox-dog — turnspit & two other kinds.

It seems absurd proposition, that every budding tree, & every buzzing insect & grazing animal owes its form, to that form being the one *alone* out of innumerable other ones, which has been preserved. — but be it remembered how little part of the grand mystery is this. — the law of growth, that which changes the acorn into the oak. — In short all which nutrition, growth & reproduction is common to all living beings. vide Lamarck[5] vol. II p. 115 four laws.[6] |

146 Who can say, how much structure is due to external agency, without final cause either in present or past generation — thus cabbages growing like Nepenthes — cases of pidgeons with tufts &c. &c. here there is no final cause yet it must be effect of some condition of external circumstances, results of complicated laws of organization ;

147 as we see there strange plumage in pidgeons yet no change of habits, so no | corresponding change in Birds of Paradise. — All that we can say in such cases is that the plumage has not been so injurious to bird as to allow any other kind of animal to usurp its place — & therefore the degree of injuriousness must have been exceedingly small. — This is far more probable way of explaining, much structure, than attempting anything about habits —

No one can be shocked at absence of final cause. Mammae in man & wings under united elytra |

148 The law of generation is only modification, though important one of growth. Lamarck[7] vol. II, p. 120 — Observe it commences only when growth stops. —

[1] The reference is to hollyhocks. *cf.* William Herbert. *Amaryllidaceae*, London 1837, p. 366.

[2] Sarah Elizabeth Wedgwood (1793–1880), eldest sister of Darwin's wife.

[3] Hensleigh Wedgwood (1803–1891), brother of Darwin's wife This paragraph is inserted at the bottom, of the page.

[4] John Gardner Wilkinson. *op. cit.* vol. 3, p. 32 : " The Egyptians had several breeds of dogs, some solely used for the chace, others admitted into the parlour, or selected as companions of their walks ; and some, as at the present day, selected for their peculiar ugliness."

[5] Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, tome 2, p. 115 : "Les facultés communes à tous les corps vivans, c'est-à-dire, celles dont ils sont exclusivement doués, et qui constituent autant de phénomènes qu'eux seuls peuvent produire, sont : ° De se *nourrir* ... 2° De *composer leur corps* ... 3° De se développer et de s'accroître ... 4° Enfin, de se régénerer eux-mêmes, ... (This passage appears on page 106 of tome 2 of the reprint of 1873.)

[6] From this paragraph to MS. page 152 inclusive the text is written in pencil.

[7] Jean-Baptiste de Lamarck. *Ibid.* tome 2, p. 120 : " cette faculté de reproduction ne commence à jouir de son intensité que lorsque la faculté d'accroissement commence à diminuer : on sait assez combien l'observation confirme cette considération ; puisque les organes reproducteurs (les parties sexuelles), dans les végétaux comme dans les animaux, ne commencent à se développer que lorsque l'accroissement de l'individu est sur le point de se terminer." (1873 reprint tome 2, p. 110.)

Spallanzanis[1] facts in connection with buds. — They differ from possibility of concourse of two individuals, & the action *always* of two organs — instead of one part as in producing bud. — Fewer of the *lately acquired* peculiarities are transmitted than by growth — generation ; it is doubtful whether any are transmitted, for the changes in fruit trees, mentioned by Mr. K[night][2] may be caused by the diversity of stocks, on which they are grafted.[3] No[4] & more of the effects of conditions on the propagating constitution, but not structure of the parents. — Thus would a cut |
149 tree vary if planted in rich soil. I presume not, but its seeds, I presume probably would — at least the experiment of the carrot seems to show this. — This would be a curious law. Certainly Australian Dog is not affected by domestication, yet offspring are. — if Australian Dog could bud, analogy tells us, offspring would be similar to first form. — The great effect of conditions on offspring, but not on individuals is very curious & important.[5] — |

150 The existence of " law of organization " had better be shown. soil on colour of flowers, Hydrangea — black bullfinches — & all varieties must be presumed to be result of such laws. — The effect of one part being greatly developed on another, must not be overlooked. — It makes fourth cause or law of change. — The weakest part of my theory is the absolute necessity, that every organic being should cross
151 with | another — to escape it in any case we must draw such a monstrous conclusion, that every organ is become fixed & cannot vary — which all facts show to be absurd. — As there are plants in northern latitudes, which are generated by buds alone or roots, & never flower, so there may be animals as Coralline, or others which only generate once in a thousand generations. — any amount of generation may take place by gemmation, my theory will not admit this, now that tulips break by cultiva-
152 tion, can a form become permanent? because its very essence is | that little change is produced. —

The fact just alluded to of *Northern* flowers, throws enormous difficulty in the way of Mr. Knights[6] theory, without seeds are freshly transported — throw over this theory, & the sexual reproduction of species may stop for any number of generations — Gorse in Norway, which never flowers !! — How did it get there ?[7] |

153 According[8] to the above suggestion my theory would require, that individuals propagated by gemmation should be absolutely similar ; all the gorze in Norway ought to be thus characterised study von Buch.[9] Now Mr Knight[10] statement about

[1] Lazzaro Spallanzani. It seems that the reference is to Spallanzani's work on regeneration-buds, described in *An Essay on Animal Reproduction*, London 1769.

[2] Thomas Andrew Knight. " On the want of permanence of character in varieties of fruit, when propagated by graft and buds," *Trans. Hort. Soc.*, vol. 2, 1822, p. 160 : " few, if any, varieties of fruit can, with strict propriety, be called permanent, when propagated by buds or grafts."

[3] The words " it is doubtful " to " grafted " inserted between lines in ink.

[4] The word " No " added in pencil to the insertion in ink.

[5] This sentence is scored in the margins.

[6] Thomas Andrew Knight. " An account of some experiments on the fecundation of vegetables ", *Phil. Trans. Roy. Soc.* 1799, p. 195. *cf.* Charles Darwin. *Variations in animals and plants* . . . , London 1868, vol. 2, p. 175 : " it is a law of nature that organic beings shall not fertilise themselves for perpetuity. This law was first plainly hinted at in 1799, with respect to plants, by Andrew Knight." This principle is sometimes referred to as the Knight-Darwin law.

[7] These five words crossed out.

[8] From here the text is written in ink.

[9] Leopold von Buch. *Reise durch Norwegen und Lappland*, Berlin 1810. These 13 words enclosed between square brackets.

[10] Thomas Andrew Knight. " On the want of permanence of character in varieties of fruit when propagated by grafts and buds," *Trans. Hort. Soc.*, vol. 2, 1822, p. 160.

fruit-trees grafted altering is hostile to this: but on other hand, fruit trees are propagated by means, which wild plants never are, namely on stocks of other varieties & we know that the kind of stock greatly affects the graft. — Plants circumstanced as the gorze must be propagated by its roots: now it is curious Mr K[night][1] has observed that to graft from the roots is the best way to get young trees from worn-
154 out | kinds, & quotes from Pliny that it is bad to graft from top shoots. — If prolongation of life by gemmation being impossible can be overturned, then the conclusion that the two kinds of generation have some most important difference is forced on us. — My theory only requires that organic beings propagated by gemmation do not now undergo metamorphosis, but to arrive at their present structure they
155 must have been propagated by | sexual commerce. The fact of corallaria & Halimeda is case in point. — The relation of these sexual functions to complexity is evident, yet the inference from *some* plants & *some* mollusca being hermaphrodite is, that intercourse every time is of no consequence in that degree of development — It is singular there is no true hermaphrodite in beings which have[2] fluid sperma. —)

I[3] utterly deny the right to argue against my theory because it makes the world
156 far *older* than what geologists think: it would be doing what | others but fifty years since [did] to geologists, — & what is older — what relation in duration of planet to our lives — Being myself a geologist, I have thus argued to myself, till I can honestly reject such false reasoning |

157 Bell[4] Bridgewater Treatise on the Hand. — p. 94. " The resemblance of the foot of the Ostrich to that of the camel has not escaped naturalists ". Before he alludes to the resemblance of the snout of the mole & Pig in having two additional bones to give strength to it. — p. 139. Doubts altogether the law of balancing of organs.[5] — In the Batrac[h]ian Order the 32 ribs are wanting. p. 144 in the Ichthyosaurus 60 or 70 bones in the paddle, yet all in the arm are perfect. — p. 144. Alludes to two theories; — the species are the result of circumstances;[6] — or the will of the
158 animal. | p. 145. Seems to argue, that as the transformation from the egg, a larva, or foetus to perfect animal are adapted by foreknowledge,[7] so must the mutations of species !! — p. 203 Chaetodon squirting water at fly,[8] — instinct, for how could

[1] Thomas Andrew Knight. " Upon the advantage of propagating from the roots of old ungrafted fruit trees ", *Trans. Hort. Soc.*, vol. 2, 1822, p. 252.

[2] The words " which have " substituted in pencil for " with ". This sentence enclosed between square brackets.

[3] From here to the end of page 156 the Text is written in pencil.

[4] Sir Charles Bell. *The Bridgewater Treatises. The Hand, its mechanism and vital endowments as evincing design*, London 1833, p. 94.

[5] Sir Charles Bell. *Ibid.* p. 139: " Shall we follow a system which informs us that when a bone is wanting in the cavity of the ear we are to seek for it in the jaw?" With a rare degree of irony, this is exactly what Reichert's established theory of homologies of the mammalian ear-ossicles requires in demonstrating that the malleus and incus of the mammal are the articular and quadrate of the reptile.

[6] Sir Charles Bell. *Ibid.* p. 144: " It is, above all, surprising with what perverse ingenuity men seek to obscure the conception of a Divine Author, an intelligent, designing and benevolent Being—rather clinging to the greatest absurdities, or interposing the cold and inanimate influence of the mere " elements", in a manner to extinguish all feelings of dependence in our minds, and all feelings of gratitude."

[7] Sir Charles Bell. *Ibid.* p. 145: " We do perceive surprising changes in the conformity of animals. Some of them are very familiar to us; but all show a foreknowledge and a prospective plan."

[8] Sir Charles Bell. *Ibid.* p. 202: " We have a more curious instance of the precision of the eye and of the adaptation of muscular action in the *Chaetodon rostratus*. This fish inhabits the Indian rivers and lives on the smaller aquatic flies. When it observes one alighted on a twig or flying near (for it can shoot them on the wing) it darts a drop of water with so steady an aim as to bring the fly down into the water, when it falls an easy prey."

experience teach distances in air, in which it never touches objects. — far better case than chicken pecking fly. — " whilst the shell sticks to its tail " as mentioned by Sir J. Banks[1] p. 212. — p. 282. Allows this instinctive power in chicken, yet says it is evidently acquired by experience in baby[2] |

159 Lamarck[3] vol. II, p. 152 Philosophie Zoologie. says it is not sufficiently proved that any shell fish is really hermaphrodite, & even oyster may fecundate each other, by the means of the medium in which they live.

ditto[4] " Additions " p. 454. — does really attribute metamorphoses to *habits* of animals & takes series of flying mammifers — says lemur volans has skin between its legs. — strangly consider existing long-organized forms as parent forms of existing highly organised forms — this resulted from the necessity of supposing some inward progressive developing power. — |

160 My theory leaves quite untouched the question of spontaneous generation. —

Introduction to Bartrams[5] Travels p. XXIII. Both sexes of some birds sing equally well, and then reciprocally assist in domestic cares, as building nest, sitting on eggs & feeding & defending their young. — The oriolus (icterus cat.) is an instance of this, & the female of the icterus minor is a bird of more splendid plumage than the male. — |

161 Athenaeum[6] May 18 1839, p. 377. — Statement that the climate is on the decline, as far as vegetation is concerned, in parts of the Northern French expedition, — rather the reverse of facts stated by Smith[7] of Jordan Hill. — |

162 May 27th Henslow.[8] One of the 4 species of Lemma only reproduces itself in hybrid, as yet observed by buds — (the other three by buds & seeds though by the latter very rarely) here is a case in answer to Mr Knights[9] doctrine. — Case like Corallina —

[1] Sir Charles Bell. *Ibid.* p. 212 : " The late Sir Joseph Banks, in his evening conversations, told us he had seen, what many perhaps have seen, a chicken catch a fly whilst the shell stuck to its tail."

[2] Sir Charles Bell. *Ibid.* p. 282 : " This faculty of reaching for the object is slowly acquired in the child ; and, in truth, the motions of the eye are made perfect, like those of the hand, by slow degrees. . . . It is no contradiction to this, that the faculty of vision is made perfect in the young of some animals from the beginning ; no more than that the instinct of the duck, when it runs to the water the moment that the shell is broken, should contradict the fact that the child learns to stand and walk after a thousand repeated efforts."

[3] Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, tome 2, p. 152 : " on sait que quantité de *mollusques*, réellement hermaphrodites, se fécondent néanmoins les uns les autres. A la vérité, parmi les mollusques hermaphrodites, ceux qui ont une coquille bivalve, et qui sont fixés comme les *huîtres*, semblent devoir se féconder eux mêmes." (1873 reprint tome 2, p. 139.)

[4] Jean-Baptiste de Lamarck. *Ibid.* tome 2, p. 454 : " les écureuils volans . . . dans l'habitude d'étendre leurs membres en sautant, pour se former de leur corps une espèce de *parachute* . . . par des répétitions fréquentes de pareils sauts dans les individus de ces races, la peau de leurs flancs s'est dilatée de chaque côté en une membrane lâche qui réunit les pattes postérieurs à celle de devant." (1873 reprint tome 2, p. 416.)

[5] William Bartram. *Travels through North and South Carolina, Georgia, East and West Florida*, Philadelphia, 1791. The passage referred to is on p. xxxii of the Introduction.

[6] *Athenaeum*, 18th May 1839, p. 377 : " French scientific expedition in Northern Europe." " We learned one thing, however, which is not without interest, concerning the climate. It has long been believed that vegetation, in the more northern parts of Lapmark, is constantly on the decline ; and large tracts of land are found under the lee of the mountain, formerly covered with fir woods, where now only stumps and rotten roots of fir trees, with a few miserable birch, are to be seen."

[7] James Smith. " On the climate of the newer pliocene tertiary period." *Proc. Geol. Soc. Lond.*, vol. 3, 1839, p. 118 : " Mr. Smith observed, that many of the most common shells in the raised beds of the basin of the Clyde are identical with species found by Mr. Lyell at Uddevalla in Sweden ; and he has been induced to conclude from the arctic character of the testacea, that the climate of Scotland during the accumulation of these beds was colder than it is at present."

[8] John Stevens Henslow.

[9] Thomas Andrew Knight. " An Account of some experiments on the fecundation of vegetables." *Phil. Trans. Roy. Soc.*, vol. 89, 1799, p. 195. See above footnote to MS. page 152.

Does it flower anywhere? Yes on the Continent [1]— is there more variation in its character.? — No — well characterized. —

Tulips are cultivated during several years & then they break. — each tulip is the product of fresh bud — here then is case of change analogous to change in grafted trees : so is not effect of different stocks in this case — & strong case showing analogy of production by gemmation & by seed — which Henslow is inclined to think very close. — A fruit tree by certain treatment will suddenly send forth quantities of blossoms. — |

163 The case of the Lemna, and the viviparous grasses, which no doubt are propagated during hundreds of years, without fresh seeds arising, — throws a very great difficulty on my theory, here we have a plant remaining constant, without crossing, — & propagation by buds does not injure constancy of form. — is the constancy owing to similarity of conditions — & that no change would affect them in short period & hence no change would affect them, without affecting all the individuals — hence there would be real gradation in species from one region to another. — These simple forms perhaps oldest in world & hence most persistent — if forms exceedingly difficult

164 to vary, the run of chances, would prevent it varying | A plant propagating itself by buds is in same predicament, as one, in which structure does not allow of crossing with other individuals with facility — such as cryptogamic plants & true hermaphrodite mollusca, & probably corals. — these forms then ought to be very persistent, & their necessity of crossing is much less, — now certainly in the higher animals, changes seem to have been more rapid, & the facility for intermarriage is greater (Hence Dioecious plants highest — Palms &c &c) — Is there greater resemblance between carboniferous & recent mollusca, than between the corresponding acalepha ? — But if Acalepha do not cross there would by my theory [be] gradation of form from one species to other : therefore my theory does require crossing. — The case of Lemma shows dispersion of germs is not end of seminal reproduction. — Likewise grasses having seeds, — as Cocos de mer — analogy shows some most important end. — |

165–176 *excised.*

177 Cocos Isl[d] & Preparis between Andaman & Pegu abound with monkeys & squirrels. — Horsborough[2] E. J., Directory vol. II, p. 46.

Carimon Java (between Borneo & Java) Lat 5° 50′ S adjoining it are several small islands abounding with deer, — Horsborough,[3] vol. II p. 527. —

Journal of Asiatic Society[4] vol. I, p. 261 Catalogue of Birds of India

ditto p. 555 Lieut. Hutton[5] counted the ova of a tick in India & found there were

[1] These four words inserted between lines.

[2] James Horsburgh. *India Directory, or Directions for sailing to and from the East Indies, China, Australia, Cape of Good Hope, Brazil, and the interjacent Ports* : London 1936, p. 46 : " Little Coco. . . . These islands, and Preparis, abound with monkeys and squirrels ; larger animals have not been seen upon them."

[3] James Horsburgh. *Ibid.* p. 527 : " Carimon Java, . . . Adjoining to it, are several small islands and rocks, some of which abound with deer, . . . "

[4] *Journ. Asiatic Soc. Bengal*, vol. 1, 1832, p. 261. " Catalogue of Indian Birds ", comprising the collections of Major James Franklin and Mr. John Gould.

[5] Thomas Hutton. " Notes in Natural History ", *Journ. Asiatic Soc. Bengal*, vol. 1, 1832, p. 554 : On p. 555 : " I found that I had waded through the almost incredible number of 5,283 ova."

178 5,283 attached to its body | Journal of the Asiatic Soc. Vol. I, p. 335 Catalogue of animals of Nepal by B. Hodgson[1] p. 336 In the *most pestiferous* region (mentioned by Heber)[2] from which *all* mankind (& yet afterwards says native tribes can live there) flee during 8 months out of 12, — the largest mammifers in the world constantly reside & are bred[3]." take tame animals into this region between April & October & like man *almost* (this looks inaccurate C.D.) they will catch the Malaria & die. — On the other hand there are breeds of men the Thâsû & the Dhangar who can live there & do not pine visibly. p. 337 it would appear as if[4] |

179–182 *excised.*

183 The possibility of different varieties being raised by seed is highly odd — as it is not so with the esculent vegetables — how is it with hollyoaks, flaxes, &c &c ?[5] Mr. Herbert[6] in letter says distinctly, that Hollyoak reproduce each other & yet I presume seed raised in same garden. — Now this good question, single or half double — anyhow fertile because they are raised by seed. — Where has Duchesne[7] described Atavism. — ask Dr Holland[8] case where peculiarity has first appeared. — Storia della Riproduzione Vegetale by Gallesio,[9] Pisa 1816 p. 27 Dr Holland.[10] |

184 Are there instances of plants, in becoming double loosing [losing] fertility of, sometimes one sex & sometimes other, so as to become monoecious. — Are there not wild plants, some partly Dioecious ?

Mushroom Hybrids ?

Any wild plants in England which do not perfect their seed ? — What animals can be budded & rendered of great age as must be inferred from what Mr Knight[11] says. Hort. Transact. V. II, p. 252.

[1] Bryan Houghton Hodgson. " On the Mammalia of Nepal " *ibid.* vol. 1, 1832, p. 335.

[2] Reginald Heber. *Journey through the Upper Province of India, from Calcutta to Bombay,* 1824–5, (*with notes on Ceylon*) ; *to Madras, & South Provinces,* 1826 ; *& Letters written from India,* London, 1828.

[3] Bryan Houghton Hodgson. *op. cit.* p. 336 : " . . . it is worthy of remark, that in this pest-house, from which all mankind flee, during 8 months of every 12, constantly reside and are bred some of the mightiest quadrupeds in the world. The royal tiger, the panther, the leopard, the elephant, the *arna* or wild buffalo, the rhinoceros, and stags of the noblest growth, abound : and, what to our fancies is less singular, the same malarious region cherishes Boa constrictors of the largest size, and other huge creatures of their kind."

[4] Bryan Houghton Hodgson. *Ibid.* p. 337 : (the sentence continues) " the principal thought is that of inherited habits of body, or acclimatization, carried to such perfection by course of time, in respect to the great quadrupeds, as to have superseded their original and natural habits of body."

[5] From the top of the page to here the text is in pencil. This page and page 184 are written across the narrow width of the paper and have been lightly scored through.

[6] William Herbert. See footnote to MS. p. 144 *supra.*

[7] Henri-Gabriel Duchesne. Author of *Manuel du Naturaliste,* Paris 1797, in which, however, there is no entry under Atavisme.

[8] Henry Holland (1788–1873).

[9] Giorgio Gallesio. *Storia della Riproduzione Vegetale,* Pisa 1816, p. 27.

[10] Henry Holland. *Medical Notes and Reflections,* London 1839.

[11] Thomas Andrew Knight, " Upon the advantage of propagating from the roots of old ungrafted fruit trees ", (read 3rd December, 1816), *Trans. Hort. Soc.,* vol. 2, 1822, p. 252 : " the general law of nature appears to be that no living organized being shall exist beyond a limited term of years ; and that law must be obeyed. It is nevertheless in the power of man to extend the lives of individual vegetable beings far beyond the period apparently assigned by nature ; and parts of the same annual plant may be preserved through many years, perhaps through ages, though it cannot be rendered immortal." Darwin's question was answered about eighty years later by C. M. Child's experiments on rejuvenation of planarians and A. Carrell's tissue-cultures of chick heart muscle for periods far exceeding the normal life-span of poultry.

Is there any very sleepy mimosa, nearly allied to the Sensitive Plant. —

p. 290 Dr Edwards[1] in an essay on Spermatic animalcule has described instrument for galvanising them.

Cross Irish & Common hare.

Decandolle[2] has chapter on sensitive plants : Physiology |

Inside back cover.

Get Hubbersty[3] to try experiments about raising plants when they cannot [be] crossed yet.

Make Hybrid mosses — Leighton or some ones.

Father, [4] diseases common to man & animals, — likeness of children[5]

Does any annual give buds or tubers — yes — but they are same as trees. —

Shake some sleeping mimosa — do stamina of C. speciosus collapse at night, if so irritate them, as by an insect coming always at same time, see if by so doing can be made sensitive.

The function of sleeping some way useful — it is only the association which is useless.

Grandfathers handwriting to compare with my own.[6]—

BRITISH MUSEUM NATURAL HISTORY 13 OCT 1960

[1] William Francis Edwards. *Essai sur les animalcules spermatiques.* (not accessible). This subject is referred to in his *De l'influence des agens physiques sur la vie :* Paris 1824, p. 549.

[2] Augustin-Pyramus DeCandolle. *Physiologie végétale,* Paris 1832, tome 2, p. 863 : " Article II. Des mouvemens excitables par les chocs, les piqûres ou quelques causes analogues. . . . Les mouvemens les plus extraordinaires sont ceux qu'on observe dans les feuilles de plusieurs mimosées, du *Smithia sensitiva,* et de plusieurs oxalidées." This entry in pencil is written from the opposite end of the paper.

[3] Nathan Hubbersty, *cf.* " Darwin's Journal ", *Bull. Brit. Mus.* (*Nat. Hist.*) Historical Series, vol. 1, 1959, p. 5.

[4] Robert Waring Darwin.

[5] These three words in pencil.

[6] The entries on this cover are lightly scored through.

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DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

ADDENDA AND CORRIGENDA

Edited with Notes by
SIR GAVIN DE BEER and M. J. ROWLANDS

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Addenda

Of the pages excised by Darwin from his Notebooks on Transmutation of Species, 28 have been recovered. In the British Museum (Natural History) 10 pages were found among the Darwin papers and letters deposited by Mr. Robin Darwin; these are indicated by an asterisk* following the Roman number in the margin indicating the number of the Notebook concerned. The remaining 18 were found among the Darwin MSS. in the Cambridge University Library by Miss M. Skramovsky with the kind assistance of Mr. P. Gautrey; these are indicated by a dagger†. The particular Notebook from which the pages were excised was determined by comparison of the scissor-cuts with those of the stumps in the Notebooks.

The reasons which led Darwin to adopt the method of cutting pages out of his Notebooks are obscure. His entries of " All useful pages cut out ", made in December 1856, show that he wanted to use them for his large work on Species on which he was then engaged. Two of the pages printed below were found attached to the manuscript of his larger work. Attention to this fact was first kindly drawn by Professor Robert C. Stauffer of the University of Wisconsin. What the fate of the many other comparable pages can have been, it is, unfortunately, not hard to conjecture. It may not be legitimate to draw conclusions from the relatively small number of excised pages that have been found, but it is difficult to avoid asking the question why these particular pages should have been considered by Darwin to be more " useful " than many of those which he did not excise.

One of the pages, (105 from Notebook II) contains material about the similarity of nest-building instincts in different species of thrushes in the Old and New Worlds, which can be traced right through to the *Origin of Species* (World Classics edition, 1956, page 304). Another page (160 from Notebook II) on woodcocks in Madeira having lost their migratory instinct, appears in the *Essay of 1844* (Cambridge University Press edition, 1958, p. 142).

These pages are printed below in order to make the transcription of Darwin's Notebooks on Transmutation of Species as complete as the available material allows. We should like to express our thanks to Miss M. Skramovsky for her invaluable help in this work.

The page references are to the *Manuscript* pages of the Notebooks.

First Notebook

I*

151 Marcel Serres[1] p. 331. l'Institut considers that[2] Geo. Journ.[3] p. 325. Vol. IV. Ducks on rivers in Guiana. build top of trees carry duckling to the water in their beak, & the young one directly *by instinct* can dive & conceal themselves in the grass. —

Beatson[4] St. Helena says no trees succeed so well at St Helena as Pineaster & Mimosa called Botany Bay Willow

V. Dr Royle[5] introductory remarks to Himalaya Mountains — |

152 Bory St Vincent[6] Vol. III, p. 164. " L'île de la Reunion presente elle seule plus d'especes polymorphes que toute la terre ferme de l'ancien monde ". —

Considers forms in recent volcanic islets not well fixed. —

Peron[7] thinks Van Diemen's land long separated from Hobart Town — (from difference of races of men and animals) |

I*

165 Mr. Martens[8] of Zoolog Soc told me an Australian dog he had, used to burrow like fox. — a sort of internal bark. would remain for long time together in tub of water with only nose projecting. — would pull the garden bell, then run into the kennel to watch who would come to the door — would constantly do this, so was obliged to be removed. —In l'Institut[9] 1837. p. 404 account of instinct of dogs. — agreement & reason |

166 Some animals common to Mauritius & Madagascar.

Proceedings of Zoolog. Soc.[10] June 1837 p. 53. an Irish rat different from English. —

Waterhouse[11] has information respecting the Water Rat. — |

[1] Marcel de Serres. *L'Institut*, tome 5, Paris 1837, p. 331, "De la présence du fer sulfuré sublimé dans less calcaires tertiaires des environs de Montpellier ".

[2] This line is crossed out in the MS.

[3] William Hilhouse. *Geogr. J.*, vol. 4, London 1834, p. 325. " Here I have seen, at the top of a decayed eta* [tree] the nest of the tropical musk duck, which we improperly call Muscovy, with the parents bringing singly, from a height of seventy or eighty feet, their newly hatched progeny to their natural element beneath : they appear to lay hold of the duckling with the bill by the neck, ... the young though for the first time, diving fifty feet at a stretch, and hiding in the grass so as to defy pursuit — such is instinct."

[4] Alexander Beatson. *Papers relating to the Devastation committed by Goats on the Island of St. Helena*, St. Helena 1810.

[5] J. Forbes Royle. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere*, London, [1833] 1839 [1840].

[6] J. B. G. Bory St. Vincent. *Voyage dans les quatre principales îles des Mers d'Afrique*, ... Paris 1804, tome 3, p. 164 ; " L'île de la Réunion présente elle seule plus d'éspèces polymorphes que toute la terre ferme de l'ancien monde."

[7] François Péron. *Voyage de découvertes aux Terres Australes* ... Paris 1816, tome 2, p. 1.

[8] William Charles Linnaeus Martin (1798–1864), superintendent of the Zoological Society's Museum from 1830 to 1838.

[9] Anonymous. *L'Institut*, tome 5, Paris 1837, p. 404 ; " Chronique ". " Un chien, auquel on voulait apprendre à monter une échelle, fatigué ou ennuyé de cet exercice, s'en alla : mais le lendemain, on le vit retourner seul à l'échelle, et s'appliquer à réussir, comme si un mouvement d'amour-propre le poussait à tenter ce nouvel essai."

[10] William Thompson. *Proc. Zool. Soc. Lond.*, vol. 2, 1837 [June 13]. " Mammalia ", p. 52. On p. 53 ; " *Mus Hibernicus*. Irish Rat. A black rat which has been seen in the north of Ireland, ... that it had a white breast ... This individual differs from the *M. Rattus* as described by other authors, and also from specimens preserved in the British Museum, and in the collection of the Society : in the relative proportion of the tail to that of the head and the body : in having shorter ears, and in being better clothed with hair ... "

[11] George Robert Waterhouse. *Proc. Zool. Soc. Lond.*, vol. 2, 1837 (February 14). p. 15 ; describes " numerous species of the genus *Mus*, forming part of the collection presented to the Society by Charles Darwin, Esq." [*Mus tumidus*].

I†

187 Mr. Don[1] gave me instances of one species of Australian genus being found in Sumatra ; again another of other genus in Sandwich islands — A genus with species in Van Diemen's land and Tierra del Fuego. — Araucaria species. Brazil, Chile, Norfolk Isl. — Isle of Pines. — Australia. — A South American form of Lathyrus has one species in Europe ; Madagascar has several American forms — The above
188 facts evidently show that Mr. D[on] wonders | at these species being wanderers. —

Iceland no species to itself, a remark common to all northern isl[ds]. — This is interesting, because Iceland must have been all ice in time of ice transported. — This gives room to fine speculation. — Are there many *Northern genera* peculiar to itself. — |

I*

197 & Europe as to produce same one. —

Although in plants you cannot say that instincts perverted yet organization especially connected with generation certainly is. —

The dislike of two species to each other is evidently an instinct ; & this prevents breeding. now domestication depends on perversion of instincts (in plants domestication or perversion of structure especially reproductive organs) & therefore the one distinction of species would fail. But this applies only to coition & not production. But who can say whether offspring does not depend on mind or instinct of parent
198 Mem. Lord Moreton's[2] Mare. — the fact of plants going back | hybrid plants ; analogous to Men & dogs. Now if we take structure as criterion of species Hogs different species, dogs not, but if we take character of offspring, Hogs not different. some dogs different. —

Henslow[3] says (Feb 1838) that few months since in Annales des Sciences[4] paper on Botany of Tahiti.

In Charlesworth Magazine[5] Jan 1830 most curious paper on hereditary fear (like rooks with gun) of two |

Second Notebook

II*

105 How remarkable that Turdus Magellanicus in the S. Hemisphere (replaced to the North by other species) should build a nest lined with mud, in forest where not a tree in which it build, a berry on which it feeds or insects it devours is same species, yet that it should so strictly agree in habits with the Turdus *Musicus* not found in N. America whose southern range is ?

[1] David Don. " On the Coniferae at present growing in Australia ". *Edinburgh New Philosophical Journal*, vol. 14, 1833, pp. 158–159.

[2] George, Earl of Morton. *Phil. Trans. Roy. Soc.*, vol. 111, London 1821, p. 20. " A singular fact of natural history. Peculiarities of the progeny of an Arab horse from a mare that had previously bred with a Quagga ".

[3] John Stevens Henslow. Personal communication.

[4] Jean-Baptiste-Antoine Guillemin. *Annales des Sciences Naturelles*, tome 7, Paris 1837, pp. 177, 241, 349. " Zephyritis Taitensis.—Enumération des plantes découvertes par les voyageurs dans les Iles de la Société, principalement dans celle de Taïti ".

[5] Philochelidon. *Mag. Nat. Hist.*, vol. 3, London 1830, p. 35. On p. 37 ;—" It has been somewhere observed, I think, by White, that ' they are hardly to be scared by a gun ', . . . "

The black & white thrush of Azara[1] builds its nest in something same manner, much mud. — These facts show, habits hereditary whilst species have changed. |

106 *Argumentum ad absurdum.* The creative American halo has extended to Juan Fernandez in birds but ? whether to same island in plants ? — What is this halo. — continents are not stationary, unerring proofs not always continents. — it is a plastic virtue. — it is expression for ignorance

Two grand classes of varieties ; one where offspring picked, one where not. — the latter made by man & nature, but cannot be counteracted by man. — effect of external contingencies & long bred in — Mem. a statement in Mr. Wynne's book[2], about not altering breed of animals in certain countries. — |

II†

159 Major Mitchell[3] does not know whether the breeds of oxen have deteriorated or altered, but it is certain that rams & bulls from England fetch very large price as is evident to be worth introducing, instead of breeding from original Durham breed. — Native dogs & English cross readily. — thinks about half way in appearance. — bark about half way in tone — the native dogs howl most dismally, very rarely bark — are almost useless not the least notion of hunting, or keeping watch. how completely nature & instincts modified —

The partial migration of birds in same country may explain greater migrations. if America intersected wider & wider if Rio Plata birds which have originally crossed would continue to cross, means of knowing direction, mysterious

160 Were the woodcocks which came Madeira & ceased their migrations lost ?? I conceive a bird migrating from Falkland Is[d] regularly to main land proof of land having been formerly nearer. —

Selby[4], Magazine of Zoology & Botany No. XI p. 390 a slight change in enclosing a common seems in part of [*blank*] to have almost banished the Grasshopper Warbler. — yellow wagtail never seen in one district. though common on another. (golden crested wren so rare in some counties. nightingale ditto — all show how nicely adapted species to localities.

p. 390[5] young ring ouzel dive instant touch the water. — capital instance of typical land bird, having habits of a grebe, structure might follow.[6] — |

[1] Felix de Azara. *Voyages dans l'Amérique Méridionale,* Paris 1809 tome 3, p. 210. " La Grive blanche et noiratre ". On p. 211 ;—" Les habitudes naturelles de cette *grive* sont les mêmes que dans l'espèce précédente : mais elle est une peu plus rare."

[2] Wynne, possibly M. B. Wynn author of the Preface to *The Breeder's and Fancier's Pedigree Book* : *A book of forms with a preface by M. B. Wynn,* London [1879]. He was at one time the Secretary of the Mastiff Club. *cf.* I 139, 141, II 120.

[3] Thomas Livingstone Mitchell. *Three expeditions into the Interior of Eastern Australia,* etc. London 1838.

[4] Prideaux John Selby. *Mag. Zool. Bot.,* vol. 2, London 1837–38, p. 387. " The Fauna of Twizell ". On p. 390 ;—" ... the grasshopper warbler (...) which, during the early growth of many of the plantations ... might be heard in various directions, pouring forth its sibilous note, ... is rarely heard, and then only in the brushwood adjoining the moor and other open ground ... "

[5] Prideaux John Selby. *ibid.* p. 390 ;—" ... The young ... dive instinctively the moment they touch the water ... "

[6] In the middle of the page, in pencil, are the figures 7 and 23.

II†

253 *Acclimitisation*[1]

Bachman[2] tells me in Audubon[3] there is most curious history of first appearance of the S. American Pipra Flycatcher which is now becoming common — likewise of the Hirundo fulva[4] (added by Audubon in appendix) showing what changes are taking place & how birds are extending their ranges — even migratory birds like swallows.

Of migrations of birds he mentioned many most curious cases. The birds seem to follow narrow bands, certain kinds as gallinules taking the low country near coast &
254 other the mountains, & then[5] | appearing to remain about a fortnight. See Silliman's Journal 1837. Paper by Bachman.[6] that is succession of birds. — in some species as Tanagra males come first & then females in flocks as in English nightingales — other birds (& this seems common kind migration of America) migrate singly flying few miles every day & generally by night — other birds which is strictly diurnal, migrates singly by night. — others in flocks. These birds seem clearly directed by kind of country; kind of migration quite different in species of same genus. The Muscicapa solitaria stay about a fortnight in one particular part of country, like White[7] of Selborne Rock Ouzels. If the line of bands or country (These facts show the normal condition of migration)[8] |

Third Notebook

III†

47 half breed liable to vary. I asked this in many ways, but received same answer. — Thought lambs were more like father than mother. — The cross not so hardy as Black faced, but more tendency to fatten — This man confirmed my account of the Shepherd dogs. —

Aug. 24th Was struck with pink shade on plumage of the Pelican. — Mem. pink spots on Albatross, on some Gulls Flamingo — (Spoonbill waders Ibis) a law of plumage might possibly be made out. — |

48 August 25th Athenaeum[9] (1838) p. 611 L[d] Tankerville[10] account of wild cattll of Chillingham, — habits peculiar, — *young* one 2–3 days old butted violently & fell. —

[1] This heading is inserted in pencil.

[2] Rev. John Bachman. Personal communication.

[3] John James Laforest Audubon. *Ornithological Biography*, etc. Edinburgh 1839, vol. 5, p. 420. " Tyrant Flycatcher ". On p. 421 ;—" ... Pipirit [Pipirie] Flycatcher ... How wonderful it is that this bird should be found breeding over so vast an extent of country, and yet retire southwards of the Texas, to spend a very short part of the winter ! ... "

[4] John James Laforest Audubon. *ibid.* Appendix, p. 415.

[5] In pencil the figure 9 is written in the middle of the page.

[6] Rev. John Bachman. *Silliman's Journal*, vol. 30, 1836, p. 81. " On the Migration of the Birds of North America ".

[7] Gilbert White. *The Natural History of Selborne*, etc., London 1822, vol. 1, p. 114, Letter XXIV (to Thomas Pennant). On p. 115 ;—" It is remarkable that they make but a few days stay in their Spring visit, but rest near a fortnight at *Michaelmas*, ... " [ring ouzel].

[8] In pencil the figure 23 is written in the middle of the page.

[9] J. Hindmarsh. *Athenaeum*, 1838, p. 611. " On the wild Cattle of Chillingham Park ". This includes letters from Lord Tankerville and Mr. Cole, a keeper, and was followed by a discussion in which Mr. Webb Hall also took part.

[10] Charles August Bennet, 5th Earl of Tankerville 1776–1859.

gore to death the old & wounded[1] — are bad breeders & subject to the rush as all animals which breed in & in are — see Annals[2] vol. 2 1839. — colour white uniform crafty, go in file, hide their young, bold —

a Mr. W. Hall[3] remarked that it was against all rules their preserving character & breeding in & in[4] — nonsense a flock of more than 100 — Agrees nearly with account given by Boethius[5] of ancient caledonian Cattle. Instinct[6] |

III†

85 here freely. — Here we have beautiful proof of the breeding in & in (like EFFEMINATE men courage in dogs[7]), — if carried much further, if by the process this were possible, the organs doubtless would shrivel up. — This character of not having sexual plumage[8] is very common by hybrids, that are infertile. — thus the common pheasant & fowl when crossed never even lay eggs. & the men cannot hardly tell any sex by appearance. — The silver & common pheasant[9] crossed, has a cock (infertile) the breast of[10] |

86 which is like common pheasant & back like silver. — But the hen hybrid of this bird, has long tail figure, & some degree of whiteness like a male. — Thus castration, hybridity & breeding in & in tend to produce same effects. — [11]May it be said that breeding in & in tends to produce unhealthiness — or to perpetuate some organic differences. — it may be so, but this assumption as long as animals are healthy |

III†

95. Sept. 11. Mr. Blyth[12], at Zoolog. Meeting stated, that Green finch, all linnets, red pole, gold finch, hawfinch, in nursling plumage resembled that of Cross Beak. — In lark if I understand right, all species have same character which is mottle & not like[13] any existing species. — In two herons[14] *plumage* of both (nursling) quite similar. — One

[1] These seven words subsequently underlined in soft pencil, and " Ch. 3 " added between lines, referring to the 3rd chapter of Darwin's unfinished work on Natural Selection. This chapter was entitled " On the Possibility of all Organic Beings Occasionally Crossing and on the Remarkable Susceptibility of the Reproductive System to External Agencies " (*Handlist of Darwin Papers at the University Library Cambridge*, 1960). The parallel between the behaviour of the Chillingham cattle and William Cowper's hares is drawn in Darwin's Fourth Notebook MS. p. 117.

[2] J. Hindmarsh. *Ann. Nat. Hist.*, vol. 2, London 1838–1839, p. 156.

[3] Webb Hall.

[4] This sentence slightly scored out.

[5] Hector Boece (Boethius). G. Kenneth Whitehead, *The Ancient White Cattle of Britain and their Descendants*, London [1953], On p. 24 ;—" These animals, states Hector Boece (Variously spelt Boethius) in his *Scotorum Historiae* (circa 1527), ' thought thay semit meik and tame in the remnant figure of their bodyis, thay wer mair wild than ony uthir beistis, and had sic hatrent [hatred] aganis the societi and cumpany of men, that thay come nevir in the woddis na lesuris quhair thay fand ony feit or haund thairof : and ; mony dayis after thay eit nocht of the herbis that wer twichit or handillitt be men.' "

[6] This word added subsequently in pencil.

[7] The words " courage in dogs " added subsequently.

[8] The words " sexual plumage " subsequently underlined.

[9] The words " silver and common pheasant " subsequently underlined.

[10] Across the page, in pencil, were subsequently added the following ;—" Yet odd they shd have so much sexual character as they have ". The figure 17 is added in pencil.

[11] A square bracket is opened here.

[12] Edward Blyth. *Proc. Zool. Soc. Lond.*, vol. 2, 1838 [September 11] p. 115 ;—" Mr. Blyth made some remarks on the plumage and progressive changes of the crossbill . . . "

[13] The figure 12 is inserted here in pencil.

[14] William Yarrell. *Proc. Zool. Soc. Lond.*, vol. 2, 1831 [January 25] p. 27 ;—" . . . In a young bird which united in its plumage the brown spotted wing of the *Gardenian Heron* with the black head and ash-coloured back of the *Night Heron* ; thus exhibiting the change from the young to the adult bird, and proving that the two supposed species are really but one . . . "

species retained this character in adult stage, other alters entirely. In common sparrow young & female similar plumage in tree sparrow (if I understood rightly)
96 young cock & | hen all nearly similar. — in Blackbird group young like some of the species — (? do these facts indicate that the change is effected through the male ??) — Yarrell[1] observed that female of some water birds (as Phalarope) assume for breeding a more brilliant plumage than the male. — My case of Caracara N. Zelandiae.[2] —

Mr. Blyth[3] stated that there are two ducks which have pretty close representative species in England & N. America. — the teal which some authors[4] |

III†

103 Cervus campestris spotted white when a fawn compare with *fallow* ? deer & Morschus &c. &c. — like young blackbirds

Dr Bachman[5] told me that ½ Muscovy & common duck were often caught wild off coast of America — showing that hybrids can fare for themselves.

first year the bird fanciers match their birds to see which will sing *longest* & they in evident rivalry sing against each other, till it has been known one has killed itself.[6]

Sir J. Sebright[7] has almost lost his Owl-Pidgeons from infertility, — Yarrell[8] says in such case they exchange birds with some other fancier. thus *getting fresh blood* without *fresh feather* & consequent trouble in obliterating the fresh feather by crossing.[9] — |

104 It seems from Lib. of Useful Knowledge that sheep originally black & Yarrell[10] thinks the occasional production of black lambs is owing to old return. — The Rev. R. Jones[11] told me precisely the same story about southern, see p. 43 supra, breed of cattle with white heads, which years afterwards occasionally went back — (Effect of imagination on mother. white peeled rods mentioned in old Testament placed before sheep[12] — it has been thought that silver pheasants about a house made other pheasants have white feathers.). —

It certainly appears in domesticated animals that the amount of variation is soon reached — as in pidgeons no new races. — |

[1] William Yarrell. *A History of British Birds*, London 1845, vol. 3, p. 130. "The Grey Phalarope". On p. 133 ;—" . . . The females of this species appear to assume more perfect colours, in the breeding season, and to retain them longer than the males . . . "

[2] Charles Darwin. *Journal of Researches*, etc. London 1839, p. 66 ;—*Polyborus Novae Zelandiae.*

[3] Edward Blyth. Presumably unrecorded remark at a meeting of the Zoological Society.

[4] The lower half of this page lightly scored through.

[5] Rev. John Bachman. Personal communication.

[6] Edward Stanley. *A Familiar History of Birds*, London 1814, vol. 1, p. 72 ;—" Goldfinches . . . are put in small cages, with wooden backs, and placed near to, but so that they cannot see, each other ; they will then raise their shrill voices, and continue their vocal contest till one frequently drops off its perch, perfectly exhausted . . . "

[7] Sir John Sebright.

[8] William Yarrell. Personal communication.

[9] A line is drawn across the page with the figure 2 in a circle, to the right of which is the figure 12 in pencil.

[10] William Yarrell. Personal communication.

[11] *cf.* Third Notebook MS. page 43.

[12] *cf.* Introduction to First Notebook, page 28.

III†

113 Sept. 17th. Saw mule apparently fathered by a donkey with all four legs ringed with lines. — animal like large heavily made cream coloured ass. — stripe on back also. — legs reminded me strongly of Zebra. — Mem. Quagga & L[d] Morton[1] mare ringed.[2]

Owen[3] says that Bell[4] in Encyclop. of Anat. & Phys. describes a high-flying bat, which has the power of inflating its body like balloon. — by air cells connected with cheek pouches. —

Hunter's Animal Oeconomy[5] p. 45 " One of the most general marks is, the superior strength of make in the males ; and another circumstance, perhaps equally so is this strength being directed to one part more than another, which part is that most immediately employed in fighting " instances thighs of cock & neck of Bull. — is most common in vegetable feeders because males always *armed* in carnivora[6] where
114 females are peaceable — (Mem. Lucanus[7] & Copris &c) In birds singing[8] | of cocks settle point. (— do the females then fight for male & are merely most attracted). — singing best sign of most vigorous males (N.B. most strange cocks & hens being either alike or very different in recently allied genera. Guinea Fowl & Peacock) other birds display beauty of plumage. (The female (as Owen observes) in Raptorial birds largest.) —

p. 47[9] is evidently the male which recedes from the species, all females being most like offspring. (how is this with those females which put on (like some waders) the bright plumage. — thinks Hence specific characters most perfect in hermaphrodites.

Fishes[10] have no secondary characters. — p. 49[11] (wonderful case of Peahen taking *feathers* of Peacock & spurs — *no final cause here* & therefore different from Hunter. I should say females recede in organisation from specific character. — [12] |

[1] George, Earl of Morton. *Phil. Trans. Roy. Soc.*, vol. 111, London 1821, p. 20. " A singular fact of natural history. Peculiarities of the progeny of an Arab horse from a mare that had previously bred with a Quagga."

[2] These words inserted in pencil.

[3] Richard Owen. Personal communication.

[4] Thomas Bell. *The Cyclopadia of Anatomy and Physiology*, London 1836, p. 594. " Cheiroptera ". On p. 599 ;—" ... In the genus Nycteris a curious faculty is observed, namely, the power of inflating the subcutaneous tissue with air ... These large spaces are filled with air at the will of the animal, by means of large cheek pouches ... "

[5] John Hunter. *Observations on certain parts of the Animal Oeconomy*, London 1837, p. 45.

[6] The words " because " to " carnivora " inserted in pencil.

[7] *Lucanus cervus*, the stagbeetle in which species the male has enormous marndibles; in *Copris* the dung-beetle, males have large horns.

[8] The page is slightly scored through : the figure 12 inserted in pencil.

[9] John Hunter. *op. cit.*, p. 44 " An Account of an extraordinary Pheasant ". On p. 47 ;—" ... It is evidently the male which at this time at such respects recedes from the female, every female being at the age of maturity more like the young of the same species than the male is observed to be ... " On p. 49 ;—" ... the male at this time receding from the female, and assuming the secondary properties of his sex ... "

[10] Richard Owen. (In John Hunter, *ibid.*) footnote on page 47 ;—" This is not common to all animals of distinct sexes, for in fishes there is no great difference : nor in many insects : nor in dogs, as has alread been observed ; however, it is considerable in many quadrupeds, but appears to be most so in birds."

[11] John Hunter. *ibid.* p. 49 ;—" ... had a favourite pied pea-hen which had produced chickens .. were astonished by her displaying the feathers peculiar to the other sex, and appeared like a pied peacock ... "

[12] In the centre of the page in pencil is the figure 2 : at the foot the words " 11 & Chapt. I. also *Latent* Character ".

III†

147 : Hence,[1] also structure not really fitted for water, only habits & instincts — The young of the Kingfisher (p. 169) has the colour on its back bright blue. — thus young of many of the pies assume the metallic tints, such as Magpie, Jay, & perhaps all the rollers[2] — He says wherever metallic brilliancy is present in young birds, one may be sure cock & hen will be alike — I presume converse is not true for he says Hen & cock Starling alike, yet young ones *brown*. —

Is it male that assumes change, & is the offspring brought back to early type by mother ? — do these differences indicate, species changing forms ; if so domestic animals ought to show them. — anyhow not connected with habits |

148 According as child is like parent, so is *species* old : Hence young Kingfisher & pies, have long had their present plumage. How is it in Pidgeons & fowls.???

Waterton[3] p. 197 put 12 wild ducks eggs under common duck, the young crossed among themselves & I presume with common duck so often that it was impossible to say what was origin of any identical bird., for they were all colours " half wild, half tame, they came to the window to be fed, but still they had a wariness about them *quite remarkable* ", instance of old species transmitting so much longer its mental peculiarity.[4] |

Fourth Notebook

IV*

55 specify types & limits of variation, & hence indicate gaps. — by this means the laws probably would be generalized, & afterwards by the examination of the special cases, under which the individual stages in the series have been fixed, to study the physical causes. All Cuviers[5] generalization of teeth to kind of extremities come under this head.

7th November When summing up argument against my theory, doubtless the presence of animals in the present orders (not so in S. America, however) is very remarkable & none discovered before them in any part of World. — Wealden to boot. — |

56 When one sees in Coralline powers of multiplication of individuals, & yet another means for individuals (mem : transportation will be answered) one look to analogy for causes in plants where *innumerable* individuals can be produced & yet sexual apparatus. —

[1] At the top of the page, in pencil, are the words " Sexual Selection " followed by the figure 12 and the words " Good Ch. 6 keep ", referring to the chapter on Natural Selection in Darwin's unpublished MS.

Across the page, written in pencil, are the words " If masculine characters added to species, we can see why Young and Female alike ".

[2] Edward Blyth. *Mag. Nat. Hist.*, vol. 2, London 1838, p. 351. " I. Analytic descriptions of the Group of Birds composing the Order Insessores Heterogenes. No. 1 — Rollers, Bee-Eaters, and Kingfishers ; Todies, and Jacamars." On p. 354 ;—" . . . the young are excluded in a very rudimentary condition : . . . slowly elaborate a plumage, adult in appearance and texture, and which, scarcely differing from the brilliantly-tinted garb of the mature bird . . . the sexes differ slightly in the rollers and some *Halcyonidae*, wherein the young resemble the adult female . . . "

[3] Charles Waterton. *Essays on Natural History chiefly Ornithology*, London 1838, p. 197. " Notes on the Habits of the Mallard ".

[4] In the margin in pencil are the word " Wildness Reversion ". In the middle of the page are the figures 2 and 23 in pencil.

[5] Georges Cuvier. *Recherches sur les Ossemens Fossiles de Quadrupèdes* etc., Paris 1816, tome 1, pp. 60–63. (" Principles of Correlation.")

My account[1] of Circus cinereus of the Falkland Isl[d] is interesting as showing some change in habits before form. —[2] |

Corrigenda

Reference has already been made to the great difficulty experienced in transcribing the text of Darwin's Notebooks owing to indistinct formation of letters, abbreviations and slurred endings to words, telegraphic style without grammatical construction, and intercalation of phrases between lines. It was for this reason that no attempt was made to produce anything approaching a facsimile edition, but to give a text with the minimum of complication. Unfortunately, but as expected and stated, this has not been devoid of errors in transcription. Some of these are inadvertent omission of a word ; others are faulty or doubtful readings. They have emerged as a result of re-examination of the text, comparison of the text of the First Notebook with that published[3] by Professor Paul H. Barrett of Michigan State University, and a series of corrections kindly supplied by Dr Sydney Smith. The majority of these has been accepted, and a list of corrigenda drawn up, which is printed below in order to make the printed text of Darwin's Notebooks as accurate as possible.

Corrigenda to Text

First Notebook on Transmutation of Species (C.U.L. Darwin MSS. 121)

The page-references are to manuscript pages.

2. *for* nor nurses are *read* nor nuns are
8. *for* in that case [it] seems is *read* in that case surely is
15. *for* from immersage *read* from immense ages
19. *for* how on this Ehrenberg *read* how is this Ehrenberg
21. *for* of will of animals *read* of will of animal
25. *for* ? we need think that *read* ? we need not think that
26. the words from " no " to " complicated " inclusive added subsequently
27. *for* bottom of branches deaden, — so that in mammalian tree *read* bottom of branches deader, — so that in mammalia birds
33. *for* less trifling differences *read* lesser trifling differences
37. *for* we can easily see *read* we can easy see
43. *for* such or few *read* just a few
48. *for* from Arabian count[ries] *read* from Arabian coast
51. the base of excised page 51 bears the words " the nearest species often "

[1] *Zoölogy of the Voyage of H.M.S. Beagle*, London 1841, Part III. Birds. Darwin's account of the habits of *Circus cinerius* in the Falkland Islands is on pp. 30 and 31. In the *Journal of Researches*, 1839 p. 66, it is referred to under the name *Polyborus Novae Zelandiae*.

[2] At the bottom of the page some undecipherable words have been added in pencil, and, in red pencil, the figures 5 and 23.

[3] " A transcription of Darwin's First Notebook on ' Transmutation of Species ' " edited by Paul H. Barrett, *Bull. Mus. Comp. Zoöl. Harvard*, vol. 122, 1960, pp. 245–296.

64. *for* individual cannot propagate *read* individual cannot procreate
65. *for* Bears and Foxes are *read* Bears & Foxes &c.
67. *for* probable that northern *read* probably true northern
68. *for* races of man *read* races of men
77. *for* of species if few genera *read* of species of few genera
81. *for* then plants on coral islets *read* Mem. plants on coral islets
82. *for* insures often mixing of *read* insures the mixing of
91. *for* copied with list *read* copied out list ; these words inserted in pencil subsequently
93. *for* or wishes to conquer *read* or instinct to conquer
95. *for* Man : species doubtful *read* Mem : species doubtful
98. *for* tone of ideas *read* tone of voice
103. *for* or what are barriers by *read* & what are barriers but
for volcanic soil at Galapagos *read* volcanic soil of Galapagos
111. *for* others [he] assumes created *read* other animals created
the words " or hints " inserted subsequently by Darwin, are in front of instead of behind " considers " where they appear to belong
for or typical of changes *read* as typical of changes
112. *for* on three elements. p. 66 *read* or three elements p. 68
113. *for* S. H. *read* G. [S.] H.
114. *for* S. H. *read* G. [S.] H.
for giving laws and on them *read* giving laws and then
115. *for* quoted from Lyell *read* quote from Lyell
121. *for* and 30°–80° *read* dip 30°–80°
133. *for* S. Hilaire *read* G. [S.] Hilaire
136. *for* F[ox] Darwin *read* [Sir] F[rancis Sacheverel] Darwin
for ∴ *read* ∴
137. *for* but the shells *read* but then shells
140. *for* much larger, than the dom[estic] *read* much larger, than the dam
142. *for* asiatic types discernible *read* asiatic types discoverable
145. *for* often with same male *read* often with same female
for p. 23 *read* p. 28
148. *for* the two families *read* the two fine families
155. *for* would be on rays *read* would be in rays
170. *for* first approaching *read* fish approaching
175. *for* enlarged here very considerably *read* enlarged two very considerably
179. above " analogues " the words ' uses this word for similar ' inserted in pencil
192. *for* and on average *read* and daresays
193. *for* Jagonensis *read* Guyanensis
195. " No " is inserted in the margin in front of Mem.
206. *for* which wandered least *read* which has wandered least
208. *for* perfect insects *read* perfect insect
for and forms low hard to tell *read* and forms hard to tell
217. *for* we are ignorant *read* we are as ignorant
219. *for* character in offspring *read* character on offspring
for when elevated *read* where elevated

221. *for* In the flora *read* Is the flora
for transported then to *read* transported them to
223. *for* in Paris basin altered perhaps *read* in Paris basin allied to present
225. *for* the fact they are not *read* for the fact that they are not
for speculate on *read* speculate of
for and in current changes *read* and on amount changes
227. *for* have early been formed *read* have easily been formed
229. *for* grampus or an insect *read* fungus or an infusorian
230. *for* come from these *read* come from them
231. *for* the black have other mind *read* the black man other kind
236. *for* country where change *read* country when change
239. *for* cross breeding presents *read* cross breeding prevents
240. *for* these producing fertile hybrids *read* mere producing fertile hybrids
242. *for* migrating birds *read* migratory birds
246. *for* paleontogic table *read* meteorologic table
251. *for* M.D. *read* M.J.
263. *for* at what point at tree *read* at what part of tree
275. *for* Flox *read* Flax
280. *for* to say a little *read* to vary a little

Second Notebook on Transmutation of Species (C.U.L. Darwin MSS. 122)

268. *for* Roy St. Vincent *read* Bory St. Vincent

Printed page 80, line 14, *for* separated *read* separately.

Addenda and Corrigenda to Bibliographical References.

In most cases the identification of a work as the one to which Darwin referred can only be conjectural where he did not give the precise reference himself. Additional references are therefore printed below to supplement those already given. Some of these references are derived from the edition of Darwin's First Notebook published by Professor Paul H. Barrett[1]; others are due to the kindness of Dr. Sydney Smith.

Page references are to the *printed* pages of previous Numbers of this Volume of the Bulletin.

First Notebook on Transmutation of Species (C.U.L. Darwin MSS. 121)

Some of the page references to Lamarck's *Philosophie Zoologique*, Paris 1809, refer to the 1873 edition. The correct references to both editions are as follows :—

30.
footnote 6 *read* tome 1, p. 55 (1873 ed. p. 73).
,, 7 ,, tome 1, p. 59 (1873 ed. p. 76).
,, 8 ,, tome 1, p. 99 (1873 ed. p. 112).
,, 9 ,, tome 1, p. 77 (1873 ed. p. 93).

[1] " A transcription of Darwin's First Notebook on ' Transmutation of Species '." edited by Paul H. Barrett, *Bull. Mus. Comp. Zoöl. Harvard*, vol. 122, 1960, pp. 245–296.

31.

footnote 6 *read* tome 1, p. 266 (1873 ed. p. 263).
,, 7 ,, tome 1, p. 65, tome 2 p. 84 (1873 ed. tome 1 p. 82, tome 2 p. 78).

32.

footnote 1 *read* tome 2, p. 279 (1873 ed. p. 256).
,, 2 ,, tome 2, p. 283 (1873 ed. p. 259).
,, 3 ,, tome 2, p. 286 (1873 ed. p. 262).

42.

footnote 1 *read* tome 1, p. 57 (1873 ed. p. 75).
,, 2 Dr. Sydney Smith has identified the reference : J. E. Gray, " Remarks on the difficulty of distinguishing certain Genera of Testaceous Mollusca by their Shells alone, and on the Anomalies in regard to Habitation observed in certain Species ", *Phil. Trans. Roy. Soc.*, vol. 125, 1835, p. 301.

43.

footnote 1 *cf* Barrett *op. cit.*, p. 285, note 7.

45.

footnote 2 *cf.* Barrett *op. cit.*, p. 285, note 2.

50.

footnote 1. The references to Mr. Don probably refer to David Don rather than George Don. David Don was Librarian to the Linnean Society and author of numerous papers on the distribution and relations of plants. According to Dr. Sydney Smith, Darwin did much of his reading in the libraries of Learned Societies, and as Darwin's reference on the excised page 187 of the first Notebook, printed above, has definitely been identified with David Don, the other references to " Mr. Don " probably relate to him.

52.

footnote 4 *cf.* Barrett *op. cit.*, p. 288, note 50.

55.

footnote 4. The anonymous author of the paper in the *Edinb. New Phil. Journ.* has been identified by Dr. Sydney Smith as Robert Jameson (1774–1854) ; also *cf.* Barrett *op. cit.*, p. 289, note 66.

56.

footnote 3 *read* tome 1, p. 143 (1873 ed. p. 153).

57.

footnote 2 *cf.* Barrett *op. cit.*, p. 288, note 50.
,, 4 *for* N. Baer *read* Karl Ernst von Baer.
,, 5. The reference is *not* to William Darwin Fox, but to Sir Francis Sacheverel Darwin (1786–1859), son of Erasmus Darwin (1731–1802) by his second wife Elizabeth Chandos-Pole. Francis Sacheverel Darwin was therefore half-brother to Dr. Robert Waring Darwin (1766–1848, Charles Darwin's father) and uncle of Francis Galton. He travelled

widely and lived at Sydrope, Derbyshire, where he kept wild animals, including wild boars. (Karl Pearson : *The Life Letters and Labours of Francis Galton*, Cambridge 1914, vol. 1 pp. 22 & *seq.*) Information kindly supplied by Lady Barlow.

58.

footnote 2, 5, perhaps M. B. Wynn of the Preface to *The Breeders' and Fancier's Pedigree Book*. *cf.* p. 190 footnote 2 *supra*.

61.

footnote 4 *for* P. 26 *read* xxvi

64.

footnote 4. See correction to footnote 1, p. 50.
„ 6. See correction to footnote 1, p. 50.
„ 7. See correction to footnote 1, p. 50.

66.

footnote 3 *read* tome 2 p. 279 (1873 ed. p. 256)

67.

footnote 5 *cf.* Barrett *op. cit.*, p. 294, note 133.

70.

footnote 1, line 3 *for* deathe *read* deaths

73.

footnote 5 *cf.* Barrett *op. cit.*, p. 296, note 160.
„ 8 *cf.* Barrett *op. cit.*, p. 296, note 160.

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Edited with an Introduction, Notes and Appendix by
NORA BARLOW

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
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[*Cambridge University Handlist* (1960) No. 29(ii)]

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Pp. 201–278

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DARWIN'S ORNITHOLOGICAL NOTES

[*C.U.L. HANDLIST*, No. 29(ii)]

With an Introduction, Notes and Appendix

By NORA BARLOW

INTRODUCTION

In the *Handlist of Darwin Papers at the University Library Cambridge*, item 29 has the general title : *MS. notes made on board H.M.S. Beagle*, 1832–6, and 29 (ii) has the sub-title *Birds*. In the following transcript of these *Ornithological Notes* it is possible to assess the part played by ornithology in Darwin's developing thought. The actual dates when these multi-dated notes were written are of the first importance, with the corrections and additions as part of the evidence.

The *Ornithological Notes* were finished by March, 1837, as the following correspondence shows. They were then in use as drafts for the ornithological matter spread through thirteen of the twenty-three chapters of the first edition of the *Voyage of the Beagle*[1] which appeared as Vol. III of Captain FitzRoy's official account of the voyage, published by Messrs. Henry Colburn. In March, 1837, Darwin wrote to his cousin, William Darwin Fox, on the progress of this his first book : " I am now hard at work and give up everything else for it." (*Life and Letters*, I : 279).[2] Again in July he wrote to Fox : " I gave myself a holiday and a visit to Shrewsbury in June as I had finished my Journal."[3] In November of the same year he wrote to Henslow that he was " gazing in silent admiration at the first page of my own volume when I received it from the printers!"[4] It was through FitzRoy's procrastination over the other volumes that the actual publication was delayed until 1839.

Here is concrete evidence that the *Ornithological Notes* were finished before March, 1837, for they were then being used as material to dove-tail into the script for Messrs. Colburn. Thus it is interesting to note that Darwin did not begin his first *Evolution Notebook*, dated 1837, until after he had got the MS. of the voyage off his mind.[5]

Darwin, therefore, either assembled his ornithological data of the voyage after reaching England in October, 1836, while at the same time unpacking and sorting his specimens which amounted to thousands, writing up his geological observations, attending Geological and Zoological Society Meetings to which he made contributions,

[1] Henceforth referred to as *B.* 1839. Second edition, as *B.* 1845.

[2] *Life and Letters of Charles Darwin, edited by F. Darwin*, 1887, henceforth referred to as *L.* & *L.*

[3] *L.* & *L.*, I : 280.

[4] *L.* & *L.*, I : 288.

[5] See Sir Gavin de Beer's editing of Darwin's *Journal*, and of the four Notebooks on Transmutation of Species, *Bulletin of the British Museum* (*Natural History*), *Historical Series* **2**, Nos. 1–5, henceforth referred to as *B.M. Bull.*

and travelling by coach between Cambridge, London and Shrewsbury ; or else he wrote the bulk of the *Ornithological Notes* during the last period of the voyage, while still out of reach of libraries and expert opinion. Some alterations and additions were found to be necessary when he got in touch with professional scientists in England. I believe that the second alternative is the correct one, partly from the evidence of the *Notes* themselves, which will be given in footnotes as the evidence occurs ; partly from the whole lay-out of the *Ornithological Notes*, and the opportunities he had for leisurely writing during the last part of the voyage—leisure entirely lacking after his return. To me they are clearly an early assemblage of his personal experiences, written with the red-hot memory of the living bird round the skeleton list of specimens. It must be remembered that, owing to the circumstances of the voyage, and FitzRoy's meticulous conscience over his surveying duties, the *Beagle's* course along the coasts and islands of South America during the three and a half years spent on her eastern and western shores, was a very devious one. This gave Darwin the perfect opportunity for observing the distribution and limitations of species. In my view, towards the end of those three and a half years, the questions Darwin was asking were those of an evolutionist, and the belief that he collected facts at random is without foundation. Darwin is himself partly responsible for the assertion sometimes made that this was so. In a letter to Hooker, written in January, 1844, (*L. & L.*, II : 23) famous in the history of their friendship and of Darwin's slow and almost disingenuous avowal of his own revolutionary ideas, he says : " I was so struck with the distribution of the Galapagos organisms, etc., etc., and with the character of the American fossil mammifers, etc., etc., that I determined to collect blindly every sort of fact, which could bear any way on what are species." But no collection of facts with a set purpose is blind. The *Ornithological Notes* show how he was collecting, not blindly, but impartially, every sort of fact bearing on what are species.

The following chronological record of drafts of the ornithological passages culminating in the *Voyage of the Beagle*, will help to place the *Ornithological Notes* in their true perspective. Some confusion may have arisen from Darwin's dated record of his ornithological work in the early *Journal*, pp. 8 and 9, edited by Sir Gavin de Beer (*Bull. B.M.* (*N.H.*) No. 1). These references in the years 1837 to 1839 allude to the work in which he was then engaged for the *Zoology of the Beagle*, 1841, draft VI of the following list.

I. Firstly, there are the jottings in the twenty-four small 3″ × 4″ pocketbooks he carried with him on his expeditions. Birds figure hardly at all in the first year, but in the second and third years in South America, the bird entries increase, and show how he was already noting specific differences and changes of habitat. Of these small pocketbooks, some are unfortunately missing.[1]

II. Secondly, there are the largely unexplored contents of Vols. 29 i, 30 i and ii, and 31 i and ii of the *C.U.L. Handlist*. These contain the " rough notes " to which Darwin alludes in the *Ornithological Notes* MS. 69 ; and in *B.* 1839, p. 353 ; and in *B.* 1845, p. 289.[2] The four volumes, 30 i and ii, and 31 i and ii, are written partly on

[1] See *Charles Darwin and the Voyage of the Beagle*, ed. N. Barlow, 1945. Referred to as *V. of B.*, 1945.

[2] I have been greatly helped in this identification by Dr. Sydney Smith and Dr. Robert Stauffer. I have annotated with Dr. Sydney Smith's initials (S. S.) special points of indebtedness. See footnotes, p. 259 below.

Whatman paper dated 1828, and certainly antedate the *Ornithological Notes*. In them Darwin refers to his Personal Journal of the *Beagle*[1] as though these volumes were being written contemporaneously, and we know that he wrote up his Diary of the *Beagle* as soon as he had the leisure. Volumes 30 i and ii, 31 i and ii contain notes on all his specimens, and will form an important link when fully explored, for they are the drafts from which Darwin must have compiled the *Ornithological Notes* during the last periods of the voyage home. A few examples will be given, comparing equivalent passages of the *Ornithological Notes* and the earlier drafts. (See p. 259, and the Appendix on the Petise.)

III. Thirdly, there are the present *Ornithological Notes*, which I believe to be the assemblage of his ornithological knowledge gained on the South American continent and the surrounding islands, including the Galapagos Archipelago, and begun probably in 1834, and continued to the end of the voyage. The order is still basically that of his specimen numbers, and therefore chronological, and both numbering and the matter are based on Vols. 31, i and ii, *C.U.L. Handlist.* (*See* Editor's Note, Specimen Numbers, p. 208.) The material begins to be assessed as a whole, with comparisons and generalizations ; back references and forward references are given, with " vide suprà " or " vide infrà " written with a number indicating the related or identical species. Sometimes numbers are referred to ahead of those in the marginal sequence ; this is wholly in keeping with the belief that they were written during the last year of the voyage with his " rough notes " before him. He added three specimens to his list after leaving the Galapagos. The last four chapters of the *Voyage of the Beagle* are birdless, except for the interest in the species that visited or inhabited the islands at which they called.

IV. Fourthly, the first edition of *The Voyage of the Beagle, 1839* (*B.* 1839). The ornithological passages occur in 13 of the 23 chapters, and are taken, often with slight alterations, from the *Ornithological Notes*. All the longer discussions and descriptions occur, except that on the Frigate Bird. (*See* Footnote, p. 267.) Cross references will be given to page numbers in *B.* 1839, and *B.* 1845.

V. Fifthly, the second edition of the *Beagle*, published by John Murray in 1845 (*B.* 1845). Here the ornithological entries are mainly the same as in IV, with some curtailment and rather more alteration from the *Ornithological Notes*. It is worth noting how the terms " creation " and " centres of creation " are still retained in *B.* 1845—a comment often made by others. But it has not, I think, been noted that the creationist passages centering round his Galapagos experiences, originated earlier in the discussion on the ranges of bird distribution, see *B.* 1839, p. 353 ; *B.* 1845, p. 289 ; *Ornithological Notes* MS. p. 69 and Appendix. As Sir Gavin de Beer has pointed out in the Evolutionary Notebooks (*Bull. B.M.* (*N.H.*)), Darwin had grasped the principle of Natural Selection some time before he read Malthus in September, 1838, so that we can watch the progress of Darwin's developing thought and the gradual removal of obstacles in those Notebooks. Still earlier, the Ornithological Notebooks show that Darwin was groping for an evolutionary concept whilst still on board, but without the illuminating light of Natural Selection. The experience of the Galapagos Archipelago was not isolated, but was a culmination of the American

[1] See *The Beagle Diary*, ed. N. Barlow, 1933, henceforth referred to as *Diary*, 1933.

three and a half years, which I believe made him a confirmed believer in descent with modification. In his wanderings he had become physically and mentally aware of the biological barriers of sea, sterile plain and the Cordillera Range, and the part they played in geographical isolation ; the succession of forms was there before his eyes, but he had not yet found his working model of Natural Selection.

VI. Sixthly and finally follows the *Zoology of the Beagle*, Vol. II, 4to, published with the help of a Government grant in 1841.[1] Here the description of species and genera are by John Gould[2]; whilst the habits and ranges are by Darwin. The arrangement is of course systematic, and more scientific detail is given than in either stages IV or V. As Gould was obliged to leave England for his travels in Australia in 1838, while the volume was in preparation, G. R. Gray, ornithological assistant in the Zoological Department of the British Museum, took on the remaining descriptions ; but in his Preface Darwin has greatly underrated his own share, consisting of the habits and ranges. These still follow closely the *Ornithological Notes*, but are enlarged with newly acquired knowledge. Where in the *Ornithological Notes* he had been puzzled in his amateur ignorance of nomenclature and relationship, expert opinion when he reached England fully justified his untrained perception. Vol. II of the *Zoology of the Beagle* can claim to be more than an ornithological traveller's record, for it has become a fundamental step in his evolutionary purpose.

Darwin was one of the first to use observations of behaviour in species diagnosis. It was probably whilst working at *Zoology of the Beagle*, 1841, that he wrote in Notebook II, p. 82 (*Bull. B.M.* (*N.H.*) **2**, No. 3, p. 91) " Gould I see quite recognises habits in making out classification in birds "—as though he were almost surprised. Already, as a boy (*C.U.L. Handlist* 129) and in the small travel pocketbooks, his powers of perception of more than the formal attributes can be noticed, and his sympathetic participation in the lives of the creatures he observed helped him to understand their habits ; form, function, adaptation and behaviour are all brought to bear on the living aspect of each species in its own surroundings.

There are some echoes of the *Ornithological Notes* in *The Origin*, of which there are no traces in *The Voyage of the Beagle*, drafts IV and V of the above list, and only slight mention in VI. This is particularly so in the case of the Frigate Bird's vestigial characters, showing how early such questions were in his mind, waiting for a fuller evolutionary answer. The corrected Frigate Bird passage, MS. p. 79, *Ornithological Notes*, runs : " The bird never touches the water with its wings, or even with its feet ; indeed I have never seen one swimming on the sea ; one is led to believe that the deeply indented web between its toes is of no more use to it than are mammae or the marsupial bones [added] in the male sex of certain animals ; or the shrivelled wings beneath the wing-cases firmly soldered together of some Coleopterous beetles." This passage may have been added later ; but I think they record his reactions to immediate observations of function, and therefore of useless vestigial characters.

As far as I know, the only extracts that have been previously published from the *Ornithological Notes* are my own on the fauna of archipelagoes, firstly in a letter to

[1] Referred to henceforth as *Z. of B.* 1841.

[2] John Gould, 1804–1881. Taxidermist to the Zool. Soc., 1827 ; F.R.S. 1843 ; many ornithological publications.

Nature, 7th September, 1935, and in *Charles Darwin and the Voyage of the Beagle*, 1945, p. 246. Dr. Himmelfarb has questioned the early dating of the *Ornithological Notes* in her *Darwin and the Darwinian Revolution* (1959), Note 25, p. 384. Those who are interested should examine her arguments in the light of this transcript.

The passage referred to above on the fauna of archipelagoes (see p. 74 MS.), which in my belief was written in the year 1836, shows how far his ideas had reached. These ideas were constantly both guiding and receiving feed-backs from his observations during the vital South American years of the voyage. It is as though he were on the bank of a stream, discovering that all the floating straws were pointing one way; the stream of evolution explained a whole concourse of facts. In the drafts, stages I to III, described in this Introduction, many of these signs are at first only dimly apprehended; with Darwin's increasing certainty, species and their distribution in time and space, changes of form in relation to function, became the driving forces in his observations. This early underlying sense of the significance of these questions and the chances he had to test them during his travels throughout the vast South American continent, laid the foundations for his whole life's work.

If it is agreed that the main writing of the *Ornithological Notes* was completed on board, then I think it must be conceded that a concept of general laws of evolutionary development to replace the terms " creation " and " centres of creation " must have been consciously sought at the time. It is well known that these terms still found their place in *The Origin of Species*, 1859 (1st edition), p. 352. In March, 1863, Darwin wrote to J. D. Hooker: " . . . I have long regretted that I truckled to public opinion, and used the Pentateuchal term of ' creation ', by which I really meant ' appeared ' by some wholly unknown process." (*L. & L.*, III : 18.) Darwin here repeats the word " Pentateuchal " from a review of Carpenter's *Introduction to the Study of Foraminifera*, in *The Athenaeum* of March, 1863, in which the reviewer discusses Darwin's theories and his use of the word " creation ". Written in 1863, I think that Darwin could hardly have meant " long regretted " to apply only to these phrases in the *Origin*, but that his mind was reverting to the more distant past of the *Voyage of the Beagle* and his dawning hypotheses of those early years.

In the *Ornithologial Notes* Darwin's developing theories, already traced after 1837 in the Notebooks edited by Sir Gavin de Beer (*Bull. B.M.* (*N.H.*) **2**, Nos. 2–5), can now be followed back a stage further to the voyage itself. It is significant to mark the frequency of the references to the Petise story (Rhea), and to the Galapagos Archipelago, in the four Transmutation Notebooks.

EDITOR'S NOTE

Handwriting. The *Ornithological Notes* are mainly written in Darwin's more legible handwriting, except for a few almost indecipherable amendments. Spelling mistakes have been retained, as their corrections in the later years supply evidence of dating. The first page and two lines on the reverse are written in Syms Covington's handwriting; Covington was " Fiddler and boy to Poop cabin " at the beginning of the voyage, and became Darwin's amanuensis in the second year, when Darwin taught him to shoot and skin birds. He continued in Darwin's

service after the Beagle's return to England. Darwin's handwriting begins at the bottom of MS., p. 1, with five lines and vertical marginal note.

Specimen Numbers. Darwin recorded his specimens collected on the voyage, in all branches of natural history, as one numerical continuity, chronologically listed in Vols. 30 and 31, *C.U.L. Handlist.* The separate specimens in spirits were recorded in another series, entered in six notebooks labelled " Cat. Specimens in Spirits ", now preserved at Down House (S.S.). The *Ornithological Notes* are written round the framework of these two series of numbers, consecutive, but not continuous, the intervening blanks referring to types of biological specimens other than birds. Covington starts with number 185, and with only nine intervening figures, Darwin takes over at 711, when the same bird, Scolopax-Perdrix, had to be considered in the light of later finds. The last numbered bird is a land-rail from the Galapagos, number 3951.

Punctuation. Darwin's punctuation has been followed, except for some omission of full-stops. Their frequency in mid-sentence can hinder the reader in understanding Darwin's meaning. Where they suggest a pause for thought, I have sometimes replaced them by dash or comma. But in deleted passages given in footnotes, I have left them in as they were written.

Pagination. Darwin gave a central heading to each MS. page, sometimes adding date and place. To prevent interruption for the reader, these are placed in the left margin, as well as the new MS. page numbers. The end of each MS. page is marked by a vertical line in the text.

Darwin's added notes are usually written on the verso of the MS. sheet, the place of insertion indicated by a letter in the margin of the recto. The page numbers are in Darwin's hand, except for five, all numbered twos, which I have omitted, as they do not fit into this series. Darwin's page numbers run from 1 to 85, with an accidental duplication of 46. Notes 82A and 85A (error for 83A), were originally stuck with sealing-wax to the bottoms of pp. 82 and 83 respectively, which I discovered from their contexts in the photostats, beautifully confirmed by the residues of the sealing-wax (S.S.). The photostat pages from which I have mainly worked, consist of 131 sheets ; many of the 85 numbered pages have notes on their reverses, sometimes of only a few lines, which had to be photostated as separate pages.

Watermarks. The paper is J. Whatman 1834 throughout (S.S.).

Deletions, Footnotes, Brackets. Alterations of the text show changes of mind, and I have therefore given the uncorrected texts for comparison with the final versions, and have dealt with deletions in two ways. Short alterations I have placed in square brackets : [would fall *del*] ; or [*Altered from* : is perhaps the most abundant.]. When longer passages or whole arguments have been altered, I have placed the original version in a footnote. In some cases I have used the footnote for emphasizing the evidence, and occasionally I have made my own communications in the text in italics, and within square brackets. In an Appendix I have collected further information on the importance of the Petise story in Darwin's mind, taken from one of the early travel notebooks, and from No. 31 i, in the

C.U.L. Handlist; these supplement and precede the versions already given in the *Ornithological Notes*.

Square brackets and italics are my additions, and round brackets are Darwin's own. Occasionally Darwin made use of the square bracket, differentiated in the text by a large, distinct, square bracket.

Acknowledgments. I am indebted to the Librarian of the Cambridge University Library, Mr. H. R. Creswick, for giving me every facility in the Library, besides providing me with photostats from which I could work at home. Mr. P. J. Gautrey was most helpful in the Anderson Room, where Dr. Robert Stauffer's experience was also available. In the British Museum (Natural History), Mr. A. C. Townsend's counsel was most useful, whilst Miss Skramovsky, well-versed in reference hunts, came to my help. Sir Gavin de Beer gave valuable time at an early stage, and his suggestions were incorporated. Mrs. Roberton has typed for me from difficult drafts; finally Dr. Sydney Smith and Miss Sybil Fountain have given precious time on innumerable occasions, both of whom I cannot thank enough.

Itinerary of the Voyage of H.M.S. Beagle *from 27th December, 1831, to 2nd October, 1836.*

The dates are given of the arrivals and departures from the ports of call; the periods on land when the main collections of specimens were made, can thus be easily compared with the long weeks at sea, when the material was being examined and written up.

Left	England	Dec. 27, 1831
Arrived	C. Verd Isds.	Jan. 18, 1832
Left	ditto	Feb. 8, 1832
Arrived	Bahia, Brazil	Feb. 28, 1832
Left	ditto	March 18, 1832
Arrived	Rio de Janeiro	April 5, 1832
Left	ditto	July 5, 1832
Arrived	Monte Video	July 26, 1832
Left	ditto	Aug. 19, 1832
Arrived	Bahia Blanca	Sep. 6, 1832
Left	ditto	Oct. 17, 1832
Arrived	Monte Video	Nov. 2, 1832
Left	ditto	Nov. 26, 1832
Arrived	T. del Fuego	Dec. 16, 1832
Left	ditto	Feb. 26, 1833
Arrived	Falkland Isds.	March 1, 1833
Left	ditto	April 6, 1833
Arrived	Maldonado (near Monte Video)	April 28, 1833
Left	Maldonado	July 23, 1833
Arrived	Rio Negro	Aug. 3, 1833
Left	Monte Video	Dec. 6, 1833
Arrived	Port Desire	Dec. 23, 1833
Arrived	Port S. Julian	Jan. 9, 1834
Arrived	T. del Fuego	Jan. 29, 1834
Left	ditto	March 5, 1834
Arrived	Falkland Islds.	March 11, 1834
Left	ditto	April 7, 1834
Arrived	Santa Cruz River	April 13, 1834
Left	ditto	May 12, 1834
Arrived	Chiloe	June 28, 1834
Left	ditto	July 13, 1834
Arrived	Valparaiso	July 31, 1834
Left	ditto (illness)	Nov. 10, 1834
Arrived	Chiloe	Nov. 21, 1834
Left	ditto	Feb. 4, 1835
Arrived	Valdivia	Feb. 8, 1835
Left	ditto	Feb. 22, 1835
Arrived	Concepcion (earthquake)	March 4, 1835
Arrived	Gallao for Lima	July 19, 1835
Left	ditto	Sep. 7, 1835
Arrived	Galapagos Arch.	Sep. 16, 1835
Left	Galapagos Arch.	Oct. 20, 1835
Arrived	Tahiti	Nov. 15, 1835
Left	ditto	Nov. 26, 1835
Arrived	New Zealand (Bay of Islands)	Dec. 21, 1835
Left	ditto	Dec. 30, 1835
Arrived	Sydney	Jan. 12, 1836
Left	ditto	Jan. 30, 1836
Arrived	Hobart	Feb. 2, 1836
Left	ditto	Feb. 17, 1836
Arrived	Australia (St. George's Sound)	March 3, 1836
Left	ditto	March 14, 1836
Arrived	Keeling Isld	April 2, 1836
Left	ditto	April 12, 1836
Arrived	Mauritius	April 29, 1836
Left	ditto	May 9, 1836
Arrived	Cape of Good Hope S. Africa	May 31, 1836
Left	ditto	June 18, 1836
Arrived	St. Helena	July 7, 1836
Left	ditto	July 14, 1836
Arrived	Ascencion Isld	July 19, 1836
Left	ditto	July 23, 1836
Arrived	Bahia, Brazil	Aug. 8, 1836
Left	Pernambuco	Aug. 17, 1836
Anchored	at Falmouth	Oct. 2, 1836

MS.1 [*First page not in Darwin's handwriting; probably Syms Covington's, his servant on the Beagle, and copyist and assistant until 1839.*] Jan. 9.

1832: Birds. St. Jago.

185 These birds were shot in neighbourhood of Porto Praya from 16th. of Jany. to 7 of Feby. Gull.

188 Cock bird common in the interior in the table land in small flocks; females of the same colour as back of bird, — runs like a lark.

189 Uncommon. Sparrow.

190 The commonest bird on the island, generally in small flocks, both round the houses and in wild desolate places.

192 cop[1] Valleys, where there is no water, but still more abundant near water as at St. Domingo. Their stomachs contain wings etc of Orthopterous insects; and one was caught with a lizard in its craw. It is a solitary tame bird and has not the swift flight of the European species. It is the only brilliantly coloured bird in the island.

413 Eggs of the Booby, and a smaller mottled one of the Noddy. St. Pauls. April.

455 Krotophagus.[2] In the stomach were numerous remains of various Orthopterous and some Coleopterous insects. Rio de Janeiro. May.

683 Fringilla. M. Video. August.

694 Numenius, in habits like a Jack Snipe; swamps.

685 Alauda. This bird flies upwards, and then suddenly falls and with its wings expanded like some Titlarks in England in Spring time. M. Video. August.

710 [del., Vaginalis [?] — vide 99.] Bahia Blanca Septr. St. Jago

MS.1(a) The Island abounds with hawks, and a small Wren with Quails and Guinea fowl.

[*At the bottom of MS. page* 1 *are five lines in Darwin's handwriting, which continues throughout the rest of the Notes. Opposite these lines in the margin is a vertical addition:* Tinochorus Eschscholtzii Is. G. St. Hilaire cf Lesson.[3] *The rest of the summary of specimen* 710 *in the light of later knowledge continues on MS. pp.* 2 *and* 3.] Scolopax-Perdrix-Specimens (1224. & 1273) (in spirits 338 & 707). This bird is found in the whole of Southern S America, wherever there are arid sterile plains,

[1] *Cop* written in margin after a specimen number is always in C. D.'s handwriting, presumably indicating a direction to his copyist, Covington.

[2] Krotophagous. Not in *O.E.D.* In the small pocketbooks Darwin carried with him on expeditions inland, he coins the word " omni-stercivorous " for dung-eating Coleoptera; date, 4th September, 1833.

[3] The vertical addition referring to Lesson and Geoffroy St. Hilaire appear to be an addition of a later date; the pen and ink are different. Darwin calls these birds Scolopax-Perdrix throughout the Notes, emphasizing his sense of their ambiguous taxonomic position. Their numbers in his specimen list are: 711, 712, 1224 and 1273, the last collected at Maldonado in May–June, 1833. This summary of his knowledge of *Tinochorus Eschscholtzii* over the whole South American continent must therefore have been written after Sept. 7th, 1835, when the Beagle left Lima.

In *Zoology of Beagle*, 1841, Darwin writes: " In the Appendix Mr. Eyton has given an anatomical description of this bird, which partly confirms that affinity both to the Grallatores and Razores, which is so remarkable in its habits and general appearance."

or open dry pasture land. At Maldonado, on the Northern shore of the
MS. 2 Plata, it is not uncommon ; but on | the great plains, near the Sierra Ventana it is abundant. We saw it in the inland plains of S. Patagonia at S. Cruz in Lat : 50°. On the western side of the Cordilleras, at the most southern part, where the forests cease & an open country commences at Concepcion we find this bird. — It occurs throughout the whole of Chili ; & at Copiapò, it frequents the most desolate places, where scarcely another living creature can exist. In its habits & Structure it seems allied to the two genera of Scolopax & Perdrix. They are found either in pairs, or in small flocks of five or six ; but in the great plains near the Ventana, I saw as many as 30 & 40 in one flock. — Upon being approached, they [lie *del*] squat close to the ground, & are then difficult to be distinguished. When feeding, they walk rather slowly, with their legs wide apart, like Quails. — they dust themselves in roads, or sandy places. — they frequent particular (dry) [added] spots, and day after day may be found there. I observed this fact both at Maldonado & in Chili. From their squatting habits, they often rise unexpectedly close to a person. — When a pair are together, one may be shot, without the other rising. — The whole flock always rises together, & each bird utters a squeak like a snipe. — From their long scapulars, when on the wing, they fly just like snipes. — Hence all the Sportsmen of the Beagle called them ' short-billed snipes.' When once on the wing the flock generally flies to a distance, with a high irregular flight. — Occasionally I have seen them soar, like a covey of partridges.
MS. 3 — At Maldonado | I opened the stomachs of a great many specimens, & found nothing but vegetable matter ; this chiefly consisted of bits of a thick rushy grass ; pieces of the leaves of some plant, & grains of quartz. The contents of the intestines and dung. is of a very bright green colour. — At another time of year. & at another place, I found the craw full of small seeds. & a single Ant. — The birds [*altered almost illegibly to* : those I opened] were exceedingly fat. & with a strong offensive game odor. — they are however said to be excellent eating.. — Pointers set them. In the plains south of the Plata, I was told they make their nests near the borders of lakes.. & lay five or six white eggs. spotted with red. — The covering of the nostrils is soft. — Some of the specimens have a black mark like a yoke on their breasts ; I believe these to be the males. Is the black yoke, like the red Horse shoe of the English Partridge ? In la Plata the Spaniards call them ' Avecasina '. — I have seen them over a space of twenty three degrees of latitude.

711 Tail feathers from another, to repair the above specimen

712 cop Charadrius . . . *Bahia Blanca. N. Patagonia : Sept. 1832*

713 cop Podiceps. iris of eye ' scarlet red ', live in flocks. in the channels amidst the salt marshes. — do

745 cop Sterna Hab. do.

746 cop Hirundo, not very common, builds in holes in a cliff near the sea. — I

saw a flock of these birds pursuing each other & screaming, much in the same manner as the English [character *del.*] swift. — In its external
MS. 4 characters it seems also to approximate to that bird. — Hab : do. |
747 Psittacus. Living in flocks & breeding in holes in the same cliff with the last swallows. — The nest — with a rather small white egg.
cop Is it not curious, these birds being common, in a miserable desert plain country, without a single tree ? A noisy bird ; several generally, rush from their holes. at the same moment.
748 cop Larus. common. — Hab. do.
749 cop *Runs* about the sandy beachs ; its note is high & quickly repeated, [mistake of species *added above line*] like the cry of a young Kestril. —
750 Fringilla Hab. do
751 cop Sylvia, concealing itself in low thickets, habits like those of the Kitty wren. — Hab. do
779 cop Sylvia — do —
789 Alaudo — do —
814 Egg of Struthio rhea — do —
828 cop Sylvia in thickets — do —
847 cop Muscicapa. Buenos Ayres
901 Tringa. Good Success Bay. T. del Fuego. Decemb. 1832 inhabiting in small flocks the bare stony summits of the mountains [*Pencil cross in margin.*]
902 Fringilla, mountain summits, frequenting the turf bogs Hab. do.
903 Alauda [T. del Fuego *Added later*] — do —
904 Fringilla, mountain forests
970 cop Tringa. in flocks on the beaches. Goree sound. T. del Fuego
971 Sylvia — Hab. do
972 cop [Turdus *del.*] Furnarius [*Added later in pencil*] — do
1001 Fringilla — (same as 2131 Chiloe) [*Added later*] — do
1003 Emberiza. on the mountains. Hardy. Peninsular. T. del Fuego
1026 cop Motacilla. *common* on the mountains Hab : do
1027 cop do. . . . . do — do
1028 cop Falco P. Pezoporus [*Added later Addendum* 2] *See* p. 278. — do
1046 Emberiza. March. 1833. East Falkland I.
1047 do. Perhaps the male of the last bird, but they | were not shot together.
MS. 5 They are by far the commonest land bird in the Islands —
1048 Scolopax. common over the whole island ; the soil is almost everywhere so damp, & soft, that this bird can feed. — Flight perhaps not quite so rapid or irregular as the English species. —
1053 cop Sylvia. Hab. do. — Beak & legs large in proportion to size of body ; lives in the coarse herbage, on the peaty soil, close to the ground. — I never saw a bird so difficult to make to fly : frequently having marked one down to within a few yards in the open plain, I could by no means obtain another glimpse of it.—Troglodytes Platensis [*In margin, added later.*]
1054 cop Falco. — E. Falkland Isd. —

1144 cop common both here & in Tierra del Fuego.

1145 Tringa. common upland marshes. E. Falkland Isd.

1146 Sturnus ruber. Hab : do. On the east side of S. America. I saw this bird from Lat 31° to these island[s] in 52°.

cop And on the west coast as far North as Lima in 12°. — A space of 40° degrees! — (a) [*Note added on reverse of page.*] Abundant in Chili called Loyca by Molina ; is said to build on the ground. —

1147 : 1148. cop Scolopax. Hab : do. — feeding in flocks on the mud banks at head of Port Louis

1160 cop Falco, probably the male of (1054) ; as these are the only sorts common in the Falklands.

***1833* A.D.** May–June : Maldonado. on the N : shore of La Plata Furnarius rufus.

1200. cop *Maldonado* MS. 6 Commonly called Oven bird, & by the Spaniards Casita or house maker. The nest is placed in the most exposed situations. on the top of a post, on a stem of Cactus, or on a bare rock. The nest is composed of mud & bits of straw, it is strong & the sides thick : in shape it resembles an oven ; the section being that of a hemisphere, with one end | truncated ; the opening is large & arched. — within the nest. & directly in front of this, there is a partition. which reaches nearly to the roof, so as to form an antechamber or passage to the true nest. — Now. at the end of May. is busy in building. — The bird is very common, often near houses & amongst bushes. *walks* or *runs* (I mean in contradistinction to hopping), is active in its habits, feeds on Coleoptera insecta ; utters loud, peculiar shrill, *reiterated* crys. —

1201 Icterus, Exceedingly abundant in large flocks, generally making much noise : habits resemble those of the starling. Is found also at the R. Negro. Lat 40°

1202 cop MS. 6(a) Anthus. resembling in most of its habits a lark ; very common, not in flocks, will alight on a twig. Builds on the ground, nest simple : eggs (1592) spotted & clouded with red. — (a) eggs spotted with red two of them in (1592) [*Added on reverse of* 6*a*]

1203 Scolopax. Flight irregular as in Europe, makes a singular drumming noise as it suddenly stoops downwards in its flight ; this it frequently repeats whilst flying round & round in a lofty circle. — I have seen a snipe in England in the summer time behave in the very same manner. —

1204 cop Not very common : iris bright red. —

1205 cop Very abundant, a most beautiful bird ; sits on a twig or thistle ; habits like a Lanius, but not noisy, or so active. — Both this & last species appear to catch most of the insects on the wing. — Frequent the open unwooded country. The female has some grey on her back & shoulders. — |

Maldonado MS. 7

1206 Muscicapa. — common, sits on thistles ; habits like the common Eng-

lish flycatcher, but does not so generally return to the very same twig. Also occassionally feeds on the turf, in stomach coleoptera chiefly Curcŭlio's. Beak, eye-lid. & iris beautiful primrose yellow. — This bird is common over the Pampas, even so far as Mendoza at the foot of the Cordillera ; it has not however crossed that barrier into Chili. —

1207 Fringilla, common amongst the reeds in swamps ; loud shrill cry ; flight clumsy, as if the tail was disjointed : base of bill dusky orange. —

1208 cop Arenaria. on sea beach

1209 Fringilla very abundant in large flocks, is female specimen. — Male with head & gorge jet black, colours more brilliant. —

1210 cop Alcedo. not uncommon ; & on the banks of the Parana exceedingly numerous. Frequents borders of lakes & rivers ; sits on a branch or stone, takes short flights & dashes into the water to secure its prey. Its flight is neither remarkably direct or rapid, as the Europaean species, but rather weak & undulating, as one of the soft billed birds ; in its course, suddenly arrests itself, & hovers over the water. As might be expected from its figure, does not sit in the stiff & upright manner, of the Europaean species ; when seated on a twig perpetually elevates & depresses its tail. — Note low, like the clicking of two small stones. Is said to build in trees : In stomach fish, internal coating of that organ bright orange.

1211 Icterus pecoris ; common in flocks often mingled with Icterus (1201).

1212 *Maldonado* MS. 8 Frequently alights on the back | of cattle. In the same flock, there are commonly brown specimens (1212). Are those one year old birds, as amongst Sturnus vulgaris ? or females ?. — In a large flock sitting on a hedge, basking & pluming themselves in the sun. I heard many of them attempting to sing or hiss for I do not know what to call it. — The noise was very peculiar resembling bubbles of air from a small orifice passing through water, but rapidly, so as to produce an acute sound. I at first thought it came from Frogs. — N.B. This egg was obtained at B. Blanca it may possibly belong to other species, which I do not know whether I distinguished [*Later insertion from N.B.*]

1213 (same as 2169 : 70). This bird has a wide geographical range, being found [almo *del.*] wherever the country is open & tolerably dry. On the east coast I met with it everywhere from Lat : 31°. to 50° in Southern Patagonia ; [*altered from* : I saw it everywhere from Lat : 31° to Southern Patagonia in the valley of S. Cruz.] On the West coast it is likewise abundant from Lima (12°) to Concepcion (37°) It is exceedingly

G[1] MS. 8(a) common both in La Plata & Chili : [in the former country [it is *del.*] being known by the name of Callandria [*corrected to* Calandria] & in

[1] A capital G appears in the margin both at the beginning and end of the large square bracket, the significance of which I cannot explain. The substance occurs both in *Beagle* '39 and *Beagle* '45. Possibly it was for inclusion in *Z. of B.*, '41.

the latter [of *del.*] by Thenca (Molina).[1] It frequents thickets & hedges, & is very active, whilst quickly hopping about, its tail is often expanded and much used. — Near Maldonado, these birds are tame & bold ; they constantly frequent in numbers the country houses, to pick the meat ; which is hung up on the posts or walls. — If any other small bird joins in the feast, the Calandria directly chases him away. On the wide uninhabited plains of Patagonia another closely allied species appears rather wilder ; it there commonly haunts the valleys clothed with spiny bushes on the higher twigs of which it takes its stand.] [End of large

MS. 8(b) *bracket G. Beginning of Note b.*] It appears to me a curious circumstance as showing the fine shades of difference in habit, that when I first saw the second species inhabiting the plains near the Rio I thought it was different from the Maldonado species. Having procured a specimen, they were so similar, that I changed my opinion, but now Mr. Gould, [who was not aware of these facts *del.*] pronounces them to be distinct kinds, in conformity with the trifling differences of habits, of which

Maldonado however he was not aware. [*End of Note* (*b*)][2] — Its cry is harsh. In

MS. 9 the Spring it sings prettily. Molina has[3] | however much exaggerated the charms of the song, which may be compared to that of the Sedge-warbler. It is more powerful ; some harsh notes. & some very high ones are mingled with a pleasant warbling. The song is remarkable, as being far superior to that of any other South American bird ; indeed I have not heard any other bird, which properly perches itself to give continuous music. — Molina has described the nest of the Thenca, as possessing a long passage ; but I am assured by the country people, that it is a simple large nest, built externally of the prickly branches of Mimosa. —

1214 cop Limosa. legs yellow, shot near a lake

1215 cop Sylvia shot in a garden

1216 cop Exceedingly abundant, its habits generally like the Butcher bird. — But I have *often* seen it hunting a field, like a hawk, by hovering over one spot. & then proceeding onwards to another. When thus in the air, & seen from the distance, very closely resembles a hawk ; it does not

[1] The passages contained in the two additions (a) and (b) on p. 8a MS., were much corrected, with many erasures. The text before emendments is here given for comparison : " It frequents thickets & hedges, is a very active bird in its habits in its manner of [hopping *del.*] running (?) about, & expanding its tail features [*presumably slip for* feathers] reminded me of our magpie. Near Maldonado they are fierce tame & bold ; constantly frequent the country houses to pick the meat, which is hung up on the posts or walls. — If any other small bird joins in the feast, the Callandria directly chaces him away. On the great plains of Patagonia the bird appears much wilder ; it there commonly haunts the valleys, clothed with spiny bushes. — Although this bird is placed amongst the thrushes in many of its habits, & manner of catching its prey, it seems allied to the Butcher Birds. — " Clearly the final emendations of Note b were made after receiving Mr. Gould's report on his return.

[2] This is an example of the accuracy of his early field impressions receiving confirmation by the experts. See *B.* '39, p. 63, and *B.* '45, p. 55. M. d'Orbigny had already described the two species as distinct. See footnote, *B.* '39, p. 63. For d'Orbigny see p. 242.

[3] The last lines on the song of Thenca on MS. 8 are deleted, probably in error. In the *Beagle* editions the comments on the song precede the main description. See Molina, *History of Chili*, 1809.

however stoop so suddenly. Again commonly it haunts the neighbourhead of water, & will in one place remain like a kingfisher stationary, it thus catches small fish which happen to come near the Margin. — Its flight is undulatory. & as if weighed down by the weight of the Bill. In the evening this bird seats itself on a branch & continually repeats, without any alteration, a shrill & rather agreeable cry, which somewhat resembles articulate words. The Spaniards, say it is like the words ' Bien te veo ' (I see you well). & accordingly have given this name to
MS. 9 (verso) this Bird. — (a) | From their tameness, their cunning odd manners are frequently kept by children. — |

Maldonado
MS. 10
1217.1218 Xanthornus Common in large flocks. —
1219 Psittacus. Feeds in large flocks in the open plains ; are very destructive to cornfields. I was told that in one year. near Colonia del Sacramiento. 2500 were killed.
cop They build their nests close together in trees ; the whole composing one vast mass of small sticks. On the islets on the Parana I saw many of these compound nests.
1220 In small flocks feeding on the plains, in its flight & habits resembling our field-fares : Hops (*not walk*). in stomach seeds & ants. At Bahia Blanca I saw this bird pursuing & catching on the wing large coleoptera ; iris rich brown, —
1221 Himantopus, legs rose pink. This bird is very numerous, in small ; & sometimes in tolerably large flocks. on the great swampy plains & fens between the Sierra Ventana & B. Ayres. The genus has been wrongfully accused of inelegance ; the appearance of one of these birds when
cop walking about shallow water, which appears to be its favourite resort, is far from awkward.—Their cry is curiously alike to a *little* dog giving tongue when in full chace. —Often when at night sitting round our fire in those exposed plains, I have paused to discriminate between the two sounds. —
1222 Furnarius. — This bird has a considerable distribution. On the East
cop coast, it occurs from 30° (& perhaps in this & many other cases those bird[s] which frequent plains. reach much further to the North, to the
MS. 11 extreme limit of the great central plains) to 40°. I never saw | a specimen further South than this. On the west coast, it occurs from Concepciòn (where open country commences) 37°. to as far (at least) as Lima in 12°. — It constantly haunts the dryest plain parts, away from bushes & trees. Sand dunes, near the sea coast afford a very favourite resort. At Maldonado & at Bahia Blanca it is very abundant, it is very tame, most quiet solitary little bird ; being disturbed only flies to a very short distance. Is active early in the mornings & late in the evenings (like Robin) [added] : is fond of dusting itself in a road : *walks*. but cannot run. *very* quickly ; in stomach small Coleoptera, chiefly Carabidous insects. At certain times it frequently utters a peculiar shrill, but

gentle, quickly reiterated cry (so quickly reiterated as to make one [running *added*] sound). In this respect resembles the Oven bird, but as widely differs in its quietness, from that active bird. — It builds its nest at the bottom of a narrow cylindrical hole, which is said to extend horizontally to nearly six feet long. Several country men, told me, that when boys they had attempted to dig out the nests, but from their depth had nearly always failed. — The bird chooses any low little bank of firm sandy soil, by the side of a road or stream. At Bahia. Blanca, I saw a *thick* mud wall, which surrounded a house, which had been perforated by these birds in more than a score of places. When I asked the owner the cause, I had no idea, it was the work of our little friend. This affords a curious instance of want of reasoning powers ; for I saw

MS. 11(a) *verso* *Maldonado* — several repeatedly flying from one to the other side of the wall. — | (a) (721) in spirits a specimen |

MS. 12 — The Spaniards call this bird Casarita, as the oven bird Casara, although the very habit, of housemaking, from which the name is derived is in this case deficient. It shows the Gauchos have observed the Natural affinity of the two species.

1223 cop — Perdrix ; does not live in covies, [but generally in pairs. *added*] runs more & does not lie so close as the English Partridge ; not a high shrill chirp or whistle : — When riding through the country great numbers, (generally in pairs) may be seen, as when at a short distance they take no pains to conceal themselves. They are silly birds ; a man on horseback by riding in a circle or rather in a spire, round & round, each time closer & closer, so bothers the bird, that it may be knocked on the head, or noosed by a running knot. at the end of a long stick, with the greatest ease. — [? Alpine var *written in margin*] Flesh most delicately white, when cooked more so than that of Pheasant, but rather dry & flavourless. — Egg (1378) V. account of Partridge (2159) & its egg, at Valparaiso. —

1224 — Scolopax-Perdrix. see account suprà. —

1226 cop — Certhia, does not [much *added*] use its tail, yet often alights vertically on the reeds & other aquatic plants, which grow round the borders of lakes, — its resort is amongst such thickets. — iris rusty red. —

1227 cop — Certhia [*In margin* V. No. 1350 *del.*] same habitat as last species ; keep together in small flocks : in stomach various Coleoptera

1228 cop *Maldonado* MS. 13 — Certhia. This specimen is tailless : (630) in spirits has part of its tail. These feathers appear singularly liable to fall out : I could not shoot a perfect specimen : in this respect. & in the structure of the feathers, this bird is allied | to the two latter species. Haunts the same locality. & conceals itself in the reeds & thickets : iris yellow, legs pale coloured.

1229 — Fringilla. [will it resemble Galapagos species *inserted later*] feeds on the fruit of the Cactus. —

1230 — Bird. —

1231 cop Muscicapa; not very common; frequents the rushy ground. near lakes. — *walks* — base of the bill, especially of the lower mandible, & iris, bright yellow. — eyelid or cere, blackish yellow. —

1232 Emberiza. in very large flocks: feed on the ground of the open plains; as they rise together, they utter a low but shrill chirp.

1233. cop Turdus; utters a note of alarm, very like that of the common English thrush. —

1234 Fringilla, not common, in stomach seeds. —

1235 cop Rallus, easily rises, on being disturbed; base of bill — especially of lower mandible. bright green. —

1236 cop Tringa, on the inland grassy plains. —

1238 Picus, not uncommon: frequents stony places & seems to feed exclusively on the ground; the bill of this specimen was muddy to the base: in the stomach nothing but ants. — cry loud, resembling the English species, but each note more disconnected; flight undulatory after the manner of the same bird; tail seems very little used, although I have seen one, with it a good deal worn: alights horizontally. like any common bird, on the branch of a tree: but *occassionally* I have seen it clinging to a post vertically. — are rather wild, frequent the open plains. generally three or four together. — The old male has scarlet tuft on the head. & a [bill *del.*] few same coloured feathers at the corners of the mouth. The tongue is preserved in spirits (620). — |

Maldonado
MS. 14

1239 cop Lanius: not common, cry rather loud, but plaintive & agreeable: iris reddish orange; bill blue especially lower mandible. — I shot specimens, in which the narrow black & white bands on the breast are scarcely visible. & what is more remarkable, even the under feathers of the tail. are only most obscurely barred. As these changes varied in degree. I imagine they are the marks of different ages & not sex. —

1240 cop Muscicapa, in stomach chiefly Coleoptera.

1241 Fringilla not common

1242 Icterus in small flocks, in marshy places, not so abundant as the other species. —

1243. cop Scolopax, differs from (1203) in being rather larger & of different colours, [& is more common: *added*] this bird commonly makes the drumming noise, described in the other species, at such times is very wild:

1244. —Icterus, not very common, marshy places, with its beak widely open, utters a shrill, but plaintive & agreeable cry which can be heard at a long distance; the note is sometimes single & sometimes reiterated; flight heavy; is a much more solitary bird[s], than its congeners, cop although I have seen it in a flock: tongue cleft at extremity: young birds have their heads & thighs. merely mottled with scarlet.

1245 Fringilla, does not go in flocks.

1246 cop Anthus. rare

1247 Fringilla in small flocks, amongst bushes, females with very little yellow. —

1248 cop Certhia, legs blueish. —

1249 cop Certhia, iris bright yellowish orange, legs with faint tint of blue. — |

Maldonado MS. 15

1250 cop Certhia. These three latter species together with (1226 & 1228) are very similar in their habits & general appearance. The genus is both numerous in individuals. as well as in species: they all frequent & conceal themselves amongst the rushes & aquatic plants on the borders of lakes, where they busily seek for small insects, & chiefly coleoptera. In this country, they seem to play the part in the economy of nature, which Sylvia does in England. Certainly they do not resemble in their habits the true Certhias. — Are they not remotely connected with the Furnarii? In all, the legs are strong in proportion to the body; when winged they crawl with uncommon activity amongst the thickets. The structure of the tail in the whole genus. is somewhat similar. & is remarkable from the looseness of its attachment; I have seen individuals of most of the species. flying about without tails. The notes, of all those which I heard, is similar, being rapid repetition or reiteration of high, but not loud chirp. The tongue in all is bifid & with fibrous projecting points; iris in all is coloured, yellowish red. —

1251 cop Furnarius-Certhia, not very common: do not frequent thickets or borders of lakes. but feed on the *ground* in open & dry situations, & occassionally alight on the summit of a twig or thistle. — from the length of tail, flight rather peculiar: legs, blueish, very pale: I have twice seen their nests. it is placed in middle of thick bush, is made of a vast number of sticks, is nearly two feet long [& cylindrical; *added*] the passage is in a vertical position, there being a *slight* bend, at its exit & entrance into the true nest, which is lined with feathers & hair. Mouth at superior extremity. — |

Maldonado MS. 16

1252 cop Certhia legs pale colour, iris rusty red, exceedingly like to (1226) differs in length of lower mandible & curvature of upper; I scarcely believe it to be a different species, more especially as I found one specimen, which was intermediate in character between the[m] both.

1255 cop Certhia, only differs from (1248) in shape of bill upper mandible in the latter is longer. & the symphysis of the lower one is of a different shape in the two specimens. Are they varieties or species?

1256 cop Certhia, iris reddish yellowish, legs pale with tint of blue.

1257 cop Parus (?) In very small flocks, habits like European genus, there is specimen (650) in spirits, because the beak of this one is imperfect. —

1258 cop Sylvia not very common

1259 cop Sylvia uncommon; amongst reeds. —

1260 cop MS. 16(a) Furnarius same genus as (1222) this is a common bird, (a) specimen in spirits (722) is easily distinguished from the latter species, by the double reddish bands on the wings, which it shows, when flying. Its nidification is similar ; namely at the bottom of a deep hole. its note is likewise similar, being a succession of one high note. quickly reiterated ; the tone is rather more acute ; flight similar, but does not *walk*. not very tame, chiefly abounds on margin of lakes amongst the refuse, also common. on open grassy plains, always feeds on the ground. in stomach nothing but insects & nearly all coleoptera, of which several were fungi-feeders. — Often picks amongst the dry dung of cattle : tongue of a bright yellow colour. — This bird is common in la Plata, is rare on the coast of Patagonia, yet I saw some in valley of S. Cruz. is common in *Maldonado* MS. 17 the Falklands Isds. & T. del Fuego. in which latter place it inhabits the mountains, which are bare of | trees, does not frequent the sea coast. I do not believe this bird is found so far north on the West coast. —

1261 Lanius (?) legs pale blueish ; iris reddish ; I have never seen but this one specimen. Coleoptera in stomach

1262 Fringilla uncommon. —

1263 cop Charadrius. legs ' crimson red ', toes leaden colour. under surface most remarkably soft & fleshy : in small flocks common on open grassy plains, often mingled with Turdus (1220). as they rise utter plaintive cry. iris dark brown. —

1264 Rhyncops. —[1] base of bill & ' legs vermilion red '. — I have seen this bird [on the East & West coasts, between Lat. 30° & 45°. — & frequents either salt or fresh water. The specimen now at the Zoological Society was shot at a lake near Maldonado, from which the water had been nearly drained, & in consequence which swarmed with small fry. — I there myself saw. what I had heard described as having been witnessed at sea. — Several of these birds, generally in small flocks, flew backwards & forwards close to the surface of the lake. with their bills wide open, & the lower mandible half buried in the water. Thus skimming

[1] The entry under Rhyncops, the Scizzor Beak, provides interesting evidence of dating. Darwin followed up his conjectures about the sensitivity of the beak playing a rôle in the peculiar fishing habits of the species, by writing on his return home a letter to Richard Owen with a specimen of the head in spirits, asking for further enlightenment. Details will be given under footnote 1, p. 222 below.

The entry is fairly heavily corrected in a lighter ink, and the corrected version is given in the above text ; this is the text nearest to *B*. '39 and *B*. '45. I give below the uncorrected first version ; I have not found the meaning of the large square bracket near the beginning, with a large figure 11 in the margin, which figure is repeated where the bracket closes at end of entry.

" base of bill & ' legs vermilion red '. — I have seen this bird on the East & West coasts. between Lat. 30° & 45° it frequents either salt or fresh water. This specimen was shot at a lake from which the water had been nearly drained, & which swarmed with small fish. I there myself saw. what I had heard described as being seen at sea. — These birds, generally in small flocks, fly close to the surface of the water. with their bills wide open, & the lower mandible half buried in the water. They thus skim the surface & plough it as they proceed." The next ten lines have no revealing alterations, but at the foot of p. 17 the word " Occassionally " is spelt with the familiar long double s, but it is corrected, probably in the Summer of 1836. *See* Condor, p. 242.

the surface they ploughed it in their course ; the water was quite smooth & it formed a most curious spectacle to behold a flock, each bird, thus leaving on the mirror-like surface, its narrow wake. — In their flight, they frequently twist about with extreme rapidity & so dexterously manage, that the projecting lower mandible should plough up a small fish, which is secured by the upper half of their scizzor-like bill. This fact. I repeatedly saw. as, like swallows. they continued to fly backwards & forwards close before me. — Occassionally when leaving the surface of the | water, their flight was wild irregular & rapid ; they then also uttered a loud harsh cry. The length of the remiges appears quite necessary, in order to keep their wings dry. when fishing.[1] — When thus employed[2] their forms in truth resemble the symbol by which many artists represent marine birds. — The tail is much used. in steering their irregular course. These birds are common far inland, along the course of the Parana ; it is said they remain during the whole year & breed in the marshes. During the day they may be seen resting in flocks, on the grassy plains. at some distance from the water. — Being at anchor, as I have said. in one of the deep creeks between the islands of the Parana, as the evening drew to a close, one of these birds suddenly appeared. The water was quite still & many little fish were rising ; the bird, continued for a long time, to skim the surface, flying in its wild & irregular manner up & down, the narrow canal, now dark with the growing night & the shadow of the overhanging trees. At M. Video. I observed some large flocks, during the day. they were seated or standing on the mud & sand banks at the head of the harbor, in the same manner as on the grassy plains. Every evening they took flight directly to seaward. From these facts. I suspect, that the fishing by day at Maldonado, was not a common circumstance, but owing to the multitudes of small fry left by the draining water. If such is the case, we can see, how their nocturnal habits are in | accordance with the method of fishing, which probably depends as much on the sense of touch as on that of sight.[3] Besides fish, it is not improbable, that they catch other animals ; of which, many. such as Crustaceae come to the surface far more abundantly, during the night than day time.

Maldonado MS. 18

Maldonado MS. 19

[1] This sentence went through many changes. " The length of the remiges " was first deleted, and " first feathers of the wings " added above, and then also deleted, and " remiges " rewritten.

[2] Here is given a very poor diagram of the V-shaped symbol—subsequently erased.

[3] At this point in the text occur two crosses in the fainter ink, corresponding to a marginal encircled note to his copyist, Covington. " Covington leave blank of [few ? del] 3 lines." A deleted sentence follows : " It would be curious to discover, whether the flexible lower mandible is well stocked with nerves. — " The remaining description of the feeding of Rhyncops is slightly altered, but not significantly. One sentence is deleted : " The method of fishing is described in Dic : Class :. — " *del.*

An examination of *Z.B.*, '41, reveals the meaning of the instructions to Covington, and the deleted lines following. I suggest that at some date early in 1837, Darwin called in Richard Owen's help to examine the Rhyncops' head anatomically, for possible confirmation of the sensitivity of the beak. Darwin had finished the Ornithological parts of *Beagle* '39 by June, 1837, see *Preface*, and all mention of the beak resembling an organ of touch was left out of both *Beagle* '39 and *Beagle* '45. Owen's answer was not

It appears, that the whole structure of the bird, its weak bill, with the lower mandible produced[4] & long wings. are evidently adapted for such habits, & not, as according to M. Lesson,[5] to open & feed on [the *del.*] Mactrae, buried in the sand banks. —] [*End of square bracket* 11]

MS.19(a) Specimen in Spirits (711)

1268 cop Larus, common in flocks near a brackish lagoon —

1269 cop Ardea, not uncommon, also in Patagonia, hoarse cry, iris & cere bright yellow. — bill waxy color. —

1270 cop Owl uncommon, in long grass : flew readily, by day. —

1271 cop Sylvia (Male of 1259?)

1272 cop Palomba — uncommon —

1273 Perdrix-Scolopax. male of (1224). V. suprà

1274 cop Turdus

1275 cop Alectrurus, sits on the top of a thistle, from which by short flights catches its prey : sometimes alights on the ground. — In stomach a spider, (Lycosa) & Coleoptera ; tail appears useless in its flight

1276 cop Alectrurus is this different species?

1277 cop Parvus (?), Exquisitely beautiful — very rare, frequents reeds near lake. — soles of feet fine orange. I saw this bird at B. Blanca. & in a collection of birds in Chili. —

1293 cop *Maldonado* MS. 20 Owl. — Excessively numerous, mentioned by all travellers as one of the most striking features in the | ornithology of the Pampas. They live in burrows, which they excavate, on any level sandy part ; but on the Buenos Ayres side of the Plata, where the Biscatche are found, they appear exclusively to use the holes of that animal.

During the open day, but more especially in the evening, these birds may be seen in every direction, standing, frequently by pairs, on the hillock, by their burrows. Whence they quietly gaze on the passer by ; if disturbed, they either enter the hole, or, uttering a shrill harsh cry move with a remarkably undulatory flight to a short distance ; whence again they gaze at their pursuer. Occassionally, in the evening they may

written until 7th August, 1837, and the three blank lines left in the hope that the answer would arrive in time for inclusion, was not fulfilled. In *Z.B.* '41, Darwin gives the whole of Owen's answer ; after the same passage on Rhyncops' night feeding, given above, Darwin writes : " I was led by these facts to speculate on the possibility of the bill of Rhyncops, which is so pliable, being a delicate organ of touch. But Mr. Owen, who was kind enough to examine the head of one, which I brought home in spirits, writes to me that : ' The result of the dissection of the head of the Rhyncops, comparatively with that of the head of the duck, is not what you anticipated. The facial, or sensitive branches of the fifth pair of nerves, are very small ; the third division in particular, is filimentary, and I have not been able to trace it beyond the soft integument at the angles of the mouth. After removing with care the thin horny covering of the beak, I cannot perceive any trace of those nervous expansions which are so remarkable in the lamelli-rostral aquatic birds. . . . ', Owen recalls the sensitivity of a hair through the nerve at the base, and adds : ' it would not be safe to deny altogether, a sensitive faculty in the beak of Rhyncops.' " No mention of the sense of touch in Rhyncops' beak is made in *Beagle* '39 because Owen's answer did not arrive in time.

[4] " so much produced " remains in *Beagle* '39. In *Beagle* '45 it is altered to " so much projecting ".

[5] René-Primevère Lesson, *Manuel d'Ornithologie*, 2 tomes, Paris, 1828.

be heard hooting. I found in their stomachs, the remains of mice ; & I one day saw a small snake, killed & carried away. It is said, that these latter animals, are their chief object of prey during the day. If, by the means of the traps, I had not been aware how wonderfully numerous the smaller rodentia are in these open countries, it would have been an enigma to explain the support of such an infinity of owls. —

1294 cop Caracara. chimango. V. Caracara novae sembae. — P. 34

1295 Water hen, bill fine green, legs brown, toes bordered by much membrane [*Cross & line in margin*]

1296 cop Parus (?), Common on the borders of lakes or ditches with water ; frequently alights on aquatic plants ; when seated on a twig expands its tail like a fan. —

1297 Fringilla, rare & beautiful

MS. 20(a) *verso* omitted

1335 cop Procellaria. Bay of St. Mattias. Lat 43°. caught by a bent pin on a string baited with fat ; is tame & sociable, & silent ; approaches close to vessels, mingled with the Pintados ; not abundant, seldom more than one or two seen together : I saw it on both sides of the continent. Is said to build in S. Georgia ; to arrive very regularly at that place in September & to leave it at the beginning of Winter. — [*End of Note* (*a*)]

1340 cop Palomba, legs coloured dull " carmine red "[1] frequents in large flocks the Indian corn fields. — |

Maldonado MS. 21

1349 cop Thalassidromus, shot in the bay, being driven in by a gale of wind ;

MS. 21(b) *verso* walks on the water, very tame. (B) Is said to build *in holes* in the cliffs on S. Georgia : arrives regularly in September for that purpose : The sealers do not know of any other breeding place.

1378 Egg of Partridge (1223)

1382 Perdrix ; much rarer than species (1223), they are generally found several together, although not rising in a covey ; frequent the swampy

cop thickets on the borders of lakes ; are unwilling to rise & lie very close ; utter *whilst on the ground*, a whistle, which is much shriller than in the other species ; when on the wing fly to a considerable distance : meat, when cooked, snow-white. I have seen this bird at B. Blanca. Northern Patagonia.

1383 cop Ostralogus. R. Plata [*Possibly meant for Ostralegus ?*]

1384 cop Sterna do

1385 cop Palomba, exceedingly abundant, living in small flocks, in every sort

cop of locality. —

1390 Larus : soles of feet deep " reddish orange " & bill " dull arterial blood red ". Is said to *breed*. & frequents fens far inland. — Near B. Ayres attends, together with the carrion Vultures, the outskirts of the slaughtering houses. —

[1] From Werner's *Nomenclature of Colours*, Edinburgh, 1821.

1396 cop Falco, *not very uncommon.* —

N.B. [*Nota bene*] In this undulating open grassy country, birds are very numerous, especially (I refer to number of individuals as well as of species) Cassicus. & Lanius. (including such birds as Callandra). The months of May & June correspond to the early part of Winter. — It is impossible not to be struck with the great beauty of the greater number of the birds ; the most prevailing tint is yellow, & it is worth noting, that the same colour is strikingly characteristic of the Flora. — As songsters, the whole are miserably deficient ; I have not heard one, excepting perhaps the

MS. 21(a) *verso* Callandra, which | could be compared even with the second class of our English performers. —

Besides the Birds, already mentioned, there were several hawks, which I was unable to procure : The gallinazo, but the Vultur aura, I do not recollect having seen : Caracara, vulgaris :

Amongst the smaller land birds, my collection is very perfect, day. after day. walking long distances & unable to procure any other specimens. — Fringilla *1615* very common : 903 : Sturnus ruber : The Cardinal is found here : 1439 in summer the large Kingfisher of T. del Fuego : Icterus 1418. very rare : Certhia 1451 very rare : Ostrich : Vanellus 1602 : A small snow white & large lead-coloured Heron : a great crane : Ibis : a large sort of Water hen : some ducks : the black-necked swan. & swan with black tips to wings, both of which are found in T. del Fuego. — |

MS. 22

1402 cop Ptarmigan, shot on summit of Katers peak (near C. Horn) 1700 ft high : not uncommon, on the southern mountains of T. del Fuego, living on the parts above the region of forests ; either in pairs or small coveys ; not very wild ; lie close. —

1403 cop Tringa. East Falkland Isd

1404 cop Sylvia. Hab : do. —

1414. cop 1415 : 1416. From St. Fe. Lat 31°. North of B. Ayres.

1417. Sparrow. Hab. do

1418. Icterus. Hab. do : Also found very rarely at Maldonado.

1419 cop Duck. Buenos Ayres

1420 cop Plover — do

1421 cop Duck — do

1422 cop Charadrius, common in small flocks, plains of B. Ayres

1423 . in small flocks. inland —

1424 cop Shot on board Beagle. on the Plata

1425 cop From an inland marsh. — — do

1426 Icterus B. Ayres

1427 cop Small flocks, very noisy chattering bird — do

1428 cop Woodpecker Hab — do

1429 cop Grebe, fresh water — do

1430 cop 1431 cop — Birds — do

1432. Specimen of female was shot at Maldonado — do
1433 cop Charadrius. banks of the Plata — do
1434 Bird — do
1435 cop Arenaria. banks of the Plata. — do
1436 cop Duck
1437 cop Female of (1439). —
1439. cop Common, both here & at Maldonado. (October), but not in the winter, at the latter place, & therefore must be migratory. —
1444 cop Bird lives near the beach. Bahia Blanca. Northern Patagonia
1445 cop Swallow. nest in holes in cliff. — — Hab do —
1446 cop Owl. — — Hab do — |

Northern Patagonia

MS. 23

1447 cop Perdrix. frequents, sand dunes & other barren very dry places. — Is it same species with common species of La Plata ? Habits similar, but appears rather smaller ; lies closer ; country far more sterile. Bahia. (Blanca, sandy & shingle desert plains) Lat : 38°.
1448 cop Sylvia — Hab — do. —
1449 cop. Charadrius. — do —
1450 cop. Bird. Same as at Maldonado. B. Ayres.
1451 cop. Certhia : B. Ayres : not uncommon at St Fe : one specimen was shot at Maldonado : —
1452 cop — B. Ayres
1453 Shot on board Beagle in the Plata
1454 cop Duck — Bahia Blanca.
1455 cop Larus : saffron yellow, base of lower mandible brownish orange, legs yellow. but not so bright as beak. — These birds often fly 50 & 60 miles inland ; frequent slaughtering houses ; make the same noise, which the common English gulls do. when their breeding places are disturbed. Hab — do —
1456 cop Falco. — Hab — do —

[*1833*] *Rio Negro.* Lat 41° : sterile bushy plains
1458 cop Ibis, very common in large flocks in the great swampy plains between Bahia Blanca & Buenos Ayres : flight soaring. singularly graceful, the whole flock acting in concert. —
1459. cop Bird. frequently utters a loud singular cry : is very remarkable from the extreme activity, with which it runs, at the bottom of hedges & thickets ; might be mistaken for a rat ; is with difficulty made to take flight. — Rio Negro
1460 cop Thrush — T. abliventus [*added later*] Hab. do
1461 cop Callandra. V. supra — do
1462 cop Sylvia do
1463 cop Dove do |

MS. 24

1464 cop Falco. I have seen it at Maldonado. Negro.
1465 Fringilla hab. Do
1466 do. is found in small flocks, inhabiting the most sterile parts of the deserts, between the Rios, Negro & Colorado. —
1467. Furnarius: Inhabits the most arid & sterile parts, in northern [*del*]
cop Patagonia, & on the West coast, the similar country in Northern Chili; flies quietly about, & hops very quickly along the ground: often turns over & picks the dry pieces of dung. — (I saw one at Port Desire. Lat.
MS. 24(a) 48°.)
verso [*probably added later.*] (a) Specimen in spirits (728)
1468 Fringilla — Rio Negro
1469 Actively [*added*] Hops about the bushes, very much like a Parus: but also runs very quickly on the ground; utters harsh shrill quickly
cop repeated crys: does not use the pointed tail as the Certhia. — Nest is said to be very large & long, (2 ft) formed by a vertical passage, with mouth open upwards; is placed in any low thorny bush & is composed externally of the most prickly branches. This nest has, I believe, been described by Molina as belonging to the Callandra or Thenca. — Frequents in considerable number. the dry bushy valleys of the whole of Patagonia & the similar country of Chili; from which latter place comes (2193). Hab. do
1470 cop Turdus. — do —
1592 6. eggs. M. Video: 3 of Fringilla 1615: 2 of Anthus (1202). One larger one. see account of the Fringilla.

1833 *M. Video. R. Plata. November (1833).* —
1600 Lanius. beautiful, most singularly white for a land bird; rather shy;
cop rare at M. Video. common about St. Fe. Lat 31°. —
1601 cop Sylvia. M. Video
1602 Vanellus, found in Lat 30°–45°. in both sides of the | continent. — In
MS. 25 La Plata is called by the Spaniards Pteru-Pteru, in imitation of their cry; & in Chili Theghel by Molina.[1] Frequent all parts of the open grassy country & especially near lakes: Habits in many respects similar to our peewits: (a) They do not go in flocks. but commonly in pairs.
MS. 25(a) [*added on reverse of sheet*] appear to hate mankind. & I am sure deserve
verso to be hated, for their never ceasing, unvaried. loud. grating screams. pursue & fly round the head. of anyone who invades their haunts: continue their noise even in the night time, [but it is very far from true, that, this is, as Molina has stated the only time; — *del.*] To the sportsman they do much harm, by telling every other bird of his approach; to the traveller in the country, they may do good, by warning him of the mid-night robber. —
cop During the breeding season, like our Peewits feign being wounded to draw away dogs. or other enemies. — Eggs pointed oval, brownish olive,

[1] *History of Chili*, Vol. I: 213, 1809.

thickly spotted with dark brown, esteemed very good eating. — iris of eye, scarlet red. —

1603 cop [Sylvia. *del*] Tringa. M. Video
1604 cop Muscicapa. — do —
1605. Fringilla — do —
1606 cop Charadrius, in large flocks — — do —
1607 : 1608. cop two species of Tringa — — do —
1609 cop Swallow. most common sort — — do
1610 cop Trochilus, not very abundant. — do
1611. 1612. Fringilla — do
1613 cop Muscicapa — do
1614 cop Fringilla — do
1615 Fringilla : one of the most abundant birds of S. America ; on the East coast it is found from Lat 30° to T. del Fuego, abounds most in the open
cop grassy country of la Plata, but in the desert plains of Patagonia is perhaps of their few inhabitants the most common. [*Altered from* : is perhaps the most abundant]|
MS. 26 On the East coast, it is numerous as far (at least) as Lima in 12°. In the humid forests of T. del Fuego, it is far from scarce. It generally prefers inhabited places, but may be met with in the most unfrequented rocky mountains ; in the Cordillera, I saw it at an elevation, which could not be less than 8000 ft. — Although so common about the houses in la Plata, they have not the air of domestication of the English sparrow ; & although Englishmen give them that name, they as little deserve it, as the gorged Gallinazo does that of Cuervo or the rook. — They are never seen in flocks. At M. Video. found a nest on the ground, in it 3 eggs [4 *del*] white [ones *del*] spotted with brown, & one larger one also spotted with red ; I had before heard, that a bird, called Cusco, lays its egg. in the Sparrow, & other birds nest. — (1592)

1616 : 1617 Fringilla. cock & hen. shot together : M. Video
1618. cop Swallow. Hab. do
1619. cop Oven bird — do
1620 cop Callandra ?
1621. 1622 cop Cock & Hen. scissor tail. as it is called by the Spaniards. Sits on the bough of a tree, & takes short flights in pursuit of insects ; is in its
cop habits & appearance on the wing, a sort of charicature likeness of our English swallow ; In its flight turns very short, at which times, opens
MS. 26(a) & shuts its tail, sometimes in a horizontal or lateral, & sometimes in a
verso vertical position, just like a pair of scissors. | A forked tail is evidently of great utility in turning short. — We see it in the Frigate Bird ; the swallow, the Tern, & Rhyncops. In the Frigate Bird & in Rh[y]ncops, this power is possessed in the most perfect degree. *end of note* (*a*) — Is very common in the neighbourhood of B. Ayres. & frequently takes advantage of the few Ombu trees which stand near the Estancias or farm houses.—

1623 cop MS. 27 Caprimulgus. Rio Plata ; not uncommon | the wooded banks of the Parana at St. Fe : in the day time rises from the ground, on being, disturbed. in the same lazy manner as the English species. — I saw one alight on a rope in a rather diagonal position. —

1624. cop Procellaria, shot Lat 42°. 20'S. : in stomach beak of Sepia. — I saw it also off the mouth of the Plata ; rather wary, does not commonly approach vessels

1834 Janu : 1834 Port *Desire. Lat 48°. S.* dry sterile plains of shingle.

1661 Duck. 20 miles up the Harbor.

1698. cop Furnarius. tolerably common, in the most desert [*corrected from* desart] spots. — do

1699 : cop. 1700 cop two species of Lanius, both shy, scarce, solitary, frequenting the wild valleys, with thorny bushes, on a twig of which they take their stand. Hab do

1701 Fringilla not very uncommon in the valleys. do

1702 cop Furnarius, somewhat similar habits, with the species of la Plata (1222). which it may be considered to replace ; frequents dry sandy places where there are a few bushes. in which respect it differs. — Coleoptera in stomach [*added later*] — rare. — do

1703 cop Sylvia. in bushes. near sea coast. do

1704. Sparrow. apparently same as (1615) but the egg (1710) is decidedly different ; I do not however believe there is any mistake in either case ; the commonest bird on the plains. do

1705 cop Certhia — actively flying about apparently same genus with (1250). habits nearly similar. — do

1706 copied Hawk. nest in low bush. egg (1710) — do

1710 cop Egg of Hawk (1706) & sparrow (1704) — do

1752 cop Lanius. amongst bushes. *Port St. Julian. Lat : 49°*

1753 cop Sylvia Hab. do

1754 cop Furnarius same as (1702). — do

1756. cop Cormorant. skin round eyes. " campanula blue " cockles at base of upper mandible " saffron & gamboge " yellow mark between eye & corner of mouth " orpiment orange " builds in numbers on low cliff. — legs scarlet (? — do |)

MS. 28

1757 cop Larus. — Beak coloured palish " arterial blood red " legs " vermilion red ". Port St. Julian

1758 cop Hawk, iris light brown, legs gamboge yellow. Hab. do

1700 omitted [*added later*]

1771 Sparrow same as (1704). Port Desire

1772 cop (a) Caracara. (Chimango ?) vide account of genus. — *end of note* (*a*)

MS. 28(a) *verso* Hawk. iris *dark* brown. legs. blueish. do

1773 Ibis. Frequent the most desert open plains, generally in pairs, & during parts of the year in small flocks : builds nest in rocky cliffs on the sea

cop shore ; eggs dirty white freckled with pale reddish brown, circumference. over long axis seven inches. — In stomach. Cicadae. Lizards. & *Scorpions* ! Cry very singular & loud, at a distance I often mistook it for the neighing of the Guanaco. — Legs " carmine & scarlet red ", iris scarlet red. —

N.B. On the dry sterile plains of Port Desire & St. Julians, both the number of species & of individual birds is small. — Besides those enumerated. The Condor is found. — Caracara Vulgaris unfrequent. — Sturnus ruber. Scolopax-perdrix. Callandra 1220. Charadrius 1623 : each in small numbers.

1834 St. of Magellans. Feb. 1834

1778 cop : Two species of Ducks. fresh water. C. Negro

1779 cop.

1780 cop Grebe, iris scarlet red, do. do

1781 cop Hawk, iris brown. — male — — do

1782. cop Petrel legs " flax flower blue ": This bird in its habits is a complete diver ; it frequents the deep quiet creeks & inland seas of T. del Fuego ; is common, I saw many in the Beagle channel & other parts. they were present in similar situation in the Chonos archipelago Lat. 44°. — Once only have I seen an individual out in the open sea, & that was between the Falklands & T. del Fuego. On being disturbed from the surface of the water, flight direct, rapid, drops from the air like a stone, & as MS. 29 quickly | dives to a *long* distance. Commonly at the very instant of rising, with the same action, takes to the wing. This is when disturbed, otherwise it swims & dives about after the manner of a grebe. At Port Famine, I have seen these birds, in the evening, flying. of their own will. in direct lines, from one part to the other. — Sts. of Magellan

1783 cop Gull. legs & base of bill brownish cream colour. Hab, do

1784 Icterus. common, small flocks, *runs* on the ground noisy chattering bird like a starling : common in Chili & whole west coast feeds on moist pastures in large flocks. builds in bushes : can be taught to talk & is kept in cages. — called by Molina " Cureu "

1814 Egg of Avestruz petise, (?). See account. — Port Desire.

1816 cop Puffinus this bird is very abundant in the Sts. of Magellan, near Port Famine. Mr Bynoe has seen it in numbers in the deep creeks of Western Patagonia. In the inland sea. behind Chiloe. Lat 40°. there were more of these birds together, than I ever saw of any other sort. Hundreds of thousands flew in an irregular line in one direction for several hours ; when the flock settled on the water, its surface was black with their numbers.[1] It is said in Chiloe, that these birds are very

[1] Written in margin : " 1624 off mouth of Plata. Wary would not approach Vessel Beak of Cuttlefish " The reference number is to specimen number 1624, Procellaria, the Great Nelly or Breakbones, Quebrantahuesos of the Spaniards. See *Beagle* '39, p. 354, *Beagle* '45, p. 289. Beneath the note is added " Callao ".

irregular in their movements, appearing in certain places in vast numbers, & on the next day not one being there visible. At this time the water contained clouds of small Crustaceae. When the flock was settled on the water, a cackling noise proceeded from the whole, as of human beings talking at a distance. On the East. coast of T. del Fuego in the open sea, occassionally, two or three might be seen
MS. 30 flying about. At Port Famine I had | a good opportunity of watching their habits. Early in the mornings & late in the evenings they were particularly active ; at such times they might be seen in long strings flying up & down, close to the surface of the water, with extreme rapidity. They occasionally settle on the water, & spend a great part of the day, thus resting. When thus flying backwards & forwards [distant from the shores *inserted*] they are evidently fishing, yet I scarcely ever saw one take its prey. — One being slightly wound[ed], was quite unable to dive. Stomach much distended, with a small fish & seven or eight good sized Crust Macrouri (such as 820). They are shy & wary & will but seldom approach within gun shot of the boat or ship. This specimen was killed late in the evening. — There is not the slightest difference in the plumage of the males & females. — In foot, the inner web is coloured " red lilac purple ", edges of all & greater part of outer web blackish : legs & half of lower mandible blackish purple.

1834 Port Famine. beginning of February. 1834

1817. cop Tringa sea. coast.

1818. Fringilla common on the outskirts of the forest.

1819 : cop 1820. cop Not uncommon in T. del Fuego, & along whole west coast, even as far as Valparaiso (2198). Near Port Famine this bird inhabits the gloomiest & darkest recesses of the great forest ; is generally seated high up amongst the tallest trees, whence it continually utters a *very* plaintive gentle whistle in the same tone. It can be heard some way, yet the sound appears to come from no particular place, direction, or distance. We were some time, before discovering its author, hidden [in] the foliage of the great trees|

MS. 31

1821 cop. Muscicapa. not uncommon on outskirts of forest, sits on a dead branch. Port Famine

1822. cop Furnarius. same as (1260) see account Hab. do.

1823 cop Furnarius, resembles the latter species. differs from it both in structure & in habits. This bird is exceedingly common over the whole of T. del Fuego & in Falkland Id : it extends some short way along the East coast, & on the west on the shores of the deep channels is very common ; it was present even as far as Northern Chili, at Copiapò. — It haunts almost exclusively, sea-beaches, whether they be rocky or shingle. I however saw [one *del*] a few a hundred miles inland, on the pebbly banks

of the S. Cruz ; & likewise in Chili, the broard beds of the rivers. constituted like sea-beachs draw them from their proper locality. (a) I
MS. 31(a) *verso* must also except a few I saw in the desolate valleys of the Cordillera, at a height that could not have been less than 8000 ft. (*End of Note* (*a*).] In T. del Fuego they feed entirely on small marine animals, at high water mark. & frequently haunt the floating kelp leaves. which grow to the surface. M. Pernetty & subsequently M. Lesson, has remarked on the very remarkable tameness of this bird ; in this respect it differs a little from the last species. & generally in its quiet habits is more allied to species (2297) : *walks* ; utters like its congeners, the same kind of shrill but not loud, quickly reiterated cry. — On Sept : 20th. (about 60 miles South of Valparaiso. 34° Lat) I found a nest of one of these birds with young birds ; it was placed, in a cavity, near the roof, at the end of a large cavern. Three months later in the Summer, in the Chonos Archipelago. Lat 45°, this bird had eggs : (What a difference in time & therefore climate in 700 miles southing!) the nest was placed in a hole beneath a tree on the coast, but hole *not excavated* : egg (2426) ; nest built of coarse grass. untidy : I was told holes in banks are also used : — |

MS. 32 In the Falkland Islands, I shot specimens (1931) which appeared much darker coloured than those of T. del Fuego, — habits same, in stomach — there was a small Cancer. brachyurus. & a Buccinium ·25 of an inch long. — If I was obliged to compare the habits of this genus to birds in England. I should say, they most resembled the wagtails, but certainly not so active. —

1824 cop Muscicapa. within gloomy forest. tame, quiet & very rare, — specimen much shattered. Port Famine

1825 cop Creeper. *rare*. actively hopping about bushes, shrill rapid note. — Hab. do.

1826 Sparrow (not uncommon) — do

1827 cop Swallow. builds in cliffs — do

1828 cop Wren, utters a very curious loud cry ; frequents the bottom of stumps of old trees, on the outskirts of the forest ; is very hard to see or to make to fly. — Hab. do —

1829 cop Wren, shot in deep forest, (cock of last ?) do

1830 Fringilla, active tops of the beech trees, within deep forest, wild. — do

1831 cop Wren. *very* abundant. outskirts of forest, this bird. & the common Certhia. two most frequent birds in the wood. —

1832 : 1833 Feathers of Ostrich. petise. see account

1834 Head of do. P. Desire. — do

1835 : 1836 Legs of do — . do

1837 feathers. Gregory bay — do

1838 Hide of do. do. — do

1875 cop Owl. bought from some Fuegians. Ponsonby Sound. —

1879 Fringilla, abundant in large flocks, in all parts of East. Falkland Isd. — very tame. —

1880 cop MS. 33 Tringa. in flocks. on sea beach. Hab. do. — | East Falkland Isd. —

1881 cop Hawk.

1882 cop Caracara vide infrà (1932 : 1933) Hab : do

1898 cop Lark, not uncommon. Hab. do : — I was informed by a Sealer that this bird is found in Georgia & South Orkneys (Lat) [*left blank by C.D.*] & that it is the only land bird on those islands. — In Georgia it must be a bird of passage, for during the greater part of the year the snow reaches to the waters edge. This lark might very properly be called Antarctica : do

1899 cop Muscicapa, inhabits chiefly the dozen & more stony hills, & likewise the sea-coast. Hab : do

1900 cop Turdus ; inhabits the same parts as the last bird, also not uncommonly around buildings, especially any old shed ; tame & inquisitive, like an English thrush ; generally silent, cry peculiar. — Hab. do

1901 cop Owl. *E. Falkland.* or Hab. do.

1915 cop Vultur aura. vide infrà Hab. do

1916 cop Hawk : female, (dissection). chiefly preys on rabbits

1917 cop Grebe : female ; male is of exactly same plumage : frequent the inland & tranquil arms of the sea. Iris dark red. — Hab. do

1918 cop Grebe, only seen in one fresh water lake ; female : legs — same colour as back, " iris scarlet & carmine red ". pupil dark. — Hab. do

1919 : 1920 Emberiza shot on the hills out of the same large scattered flock : (1920 is commonly shot in the lower land & may be seen with (1879). Hab. do

1922 Emberiza ; female ; shot with (1919). — do

1923 do. Shot on the plains ; same species or different? do

1926 cop Hawk ; male : iris " honey yellow ". Hab. do

1931 cop Furnarius. see account with (1823) — do |

MS. 34

1932 cop 1933 } Caracara. nova Zelandae ; female : 1933. sex unknown. & (1882) sex unknown). — legs " ash grey ". —

N.B. (N.B. For convenience sake. I shall here put together all my notes on *the Carrion feeders of S. America.* —)[1] *Caracara. Braziliensis* or vulgaris, is a very common bird & has a wide geographical range. I have seen it most abundant on the open plains of la Plata ; [where it is called Carrancha, but *inserted later*] it is not unfrequent. in the most desert parts of Patagonia : [*beginning of square bracket in text, ending p.* 235, *labelled* H.] [In the Traversia between the rivers Negro & Colorado, numbers constantly attend on the line of road, to devour the [carcases of the *added later*] exhausted animals, which may perish from fatigue & thirst. On the west coast. it is abundant, even as far as Lima : although

[1] See *Beagle* '39, p. 63 ; *Beagle* '45, p. 55.

thus so common over [in *del*] these open & dry [arid *del*] countries, it is nevertheless [*added*] found inhabiting the damp impervious forests of West Patagonia & Tierra del Fuego.[1] The Carrancha together with the Caracara chimango constantly attend in numbers around the Estancias & slaughtering houses ; if an animal dies on the plain, [fields *del*] the Gallinazos commence the feast, & then the two [*added*] Caracaras pick the bones clean. — These birds[2] although thus commonly feeding together, are far from being friends, When the Carrancha is quietly seated on the branch of a tree or on the ground, the chimango will continue for a long time, flying backwards & forwards, up & down, in a semicircle, trying each time at the bottom of the curve to strike his larger relative ; the Carrancha however takes little notice, excepting by bobbing his head. — [3]

MS. 35 Although the Carranchas are frequently | assembled [*added*] in numbers, they are not gregarious ; in desert places they may be seen solitary, or more commonly in pairs. Besides the carrion, of larger animals, these birds frequent the sides of streams & sea beaches to pick up whatever the [sea *del*] waters may cast up ; by these means, in Tierra del Fuego & on the west coast [it *del*] the Carrancha must entirely live. They are said to be very crafty & to steal great numbers of eggs. — they attempt, together with the Chimango, to pick off the scabs, from the sore backs of the horse & mules, — the poor animal with its ears down & back arched, [on the one hand *added*] & on the other, [above, *del*] the hovering bird, eying at the distance of a yard, the disgusting morcel, form a picture, which has been described by Capt. Head,[4] with his own spirited accuracy. The Carrancha will kill a wounded animal ; & Mr. Bynoe, near M. Video, saw one seize in the air, a live partridge, which escaped from his hold & was for a long time chased [*corrected from* chaced] on the ground. — I believe this fact to be far from common ; anyhow there is no doubt, that the chief part of their sustenance is derived from carrion. A person will discover [see *del*] the " necrophagus " habits of this Caracara by walking out on one of the desolate plains, & there lying down to sleep, when he awakes, he will see on each surrounding hillock, one of these birds patiently watching him. with an evil eye ; it is a feature in the landscape of those countries, which will be recognized

MS. 35(a) *verso* by every one who has wandered over them. (a) If a party goes out hunting with dogs & horses, it will be accompanied, during the day, by several of these attendants.

[1] Deleted paragraph : " Neither it, nor the Caracara chimango have found their way across to the Falkland Isds."

[2] Altered from : " This bird & the chimango,"

[3] Here there is a small diagram in margin crossed out. In the small pocket notebooks when near Chiloe, dated 28th November, 1834, Darwin notes : " Chimango torments swing swang the Carrancha ".

[4] *Rough notes of journeys in the Pampas and Andes.* By Sir F. B. Head, London, 1826. Travelled in S. America as manager of the Rio Plata Mining Association.

After feeding, the uncovered craw protrudes outwards [(?) *added*] at
MS. 36 such times, but likewise | generally, the Carrancha is an inactive, tame, & cowardly bird. — Its flight is heavy & slow; it is like that of an English crow. — It seldom soars, I have however twice seen it, at a great height, gliding through the air with much ease. — It *runs* [(in contra-distinction from hopping) *added*] on the ground, but not with quite so much celerity as some of its congeners. — At times the Carrancha is rather noisy but is not generally so; the cry is loud, very harsh & peculiar; it may be likened to the sound of the Spanish gutteral g, followed by a rough double rr. Perhaps the Gauchos from this cause have called it Carrancha. Molina who says it is called Tharu in Chili, states, that when uttering this cry, it elevates its head, higher & higher, till at last (with its beak wide open) the crown almost touches the lower part of the back. This fact, which has been doubted is quite true; I have seen them several times with their heads. backwards. in a completely inverted position. — The Carrancha builds a large coarse nest indifferently; in any low cliff. or in a bush or lofty tree. — (a) To these observations I may add on the
MS. 36(a) *verso* authority of Azara,[1] that the Carrancha feeds on worms shells. slugs, grasshoppers and frogs: that it destroys young lambs. by tearing the umbilical cord, and that it pursues the Gallinazo, till that bird is compelled to vomit up, the carrion it had lately gorged. Lastly Azara states that several Carranchas five or six in number. will unite in chace of large birds, even such as Herons. —] [*End of large square bracket*
H *-labelled H, beginning p. 233, and of note (a) on reverse.*] I am in great doubt about the plumage of the two sexes & ages of this bird. At Port Famine, I shot a female, apparently an old bird, with the eggs well developed in the Ovarium. Bill, cere, & legs. coloured as in description in Dic: Class[2]. — Head "Liver & blackish Br." (Over the whole plumage. this is the tint of the *dark* browns, & the *pale* browns are "yellowish Br") — Gorge rusty yellow; breast & under tail coverts banded (bands $\frac{1}{10}$th. inch wide) with pale brown & rusty yellow: Back banded with
MS. 37 dark brown: wing coverts pale brown: of 6 first | remiges, central parts whitish; under parts of secondaries broad bands. Rectrices broad bands, outer margins of outer feathers darker. Length (full stretch) 18½ inches; from tip to tip of wing 4 ft. 7 inches.

On the plains of S. Cruz. I saw *many* Caracaras, like specimen (2028). I shot several of them & opened their bodies, many were females, others, (as for instance this specimen) had the organs quite smooth. There were some with more white on their throats. — Is this the Ca. vulgaris? if so where were the old cock & old Hen birds — Yet in Chili & la Plata I

[1] *Voyages dans l'Amerique méridionale* par don Felix de Azara, 1781–1801.

[2] *Dictionnaire classique d'Histoire naturelle*, Tome 1–17, 1822–1831; this and Tome 18 of *Dictionnaire des Sciences naturelles* are catalogued in the *Library of Charles Darwin*, 1908. [S. S.]

have *occassionally* seen a pale brown variety similar (speaking from recollection) to these. — Habits same as Carrancha. — I do not know what to think. Can it be the young of Raucaria. V. infrà. —

Caracara. (1294)

J

Called in la Plata " chimango " ; this bird is very [*beginning of large square bracket J*] [common on both sides of the continent, but does not appear to extend so far northward [*added*] as the last species. It is found in Chiloe & on the coast of Patagonia,[1] & I have seen it in T. del Fuego. We have already remarked that it feeds on Carrion in company with the Carrancha ;[2] it is generally the last bird which leaves the skeleton, & may often be seen within the ribs of a cow or horse, like a bird in a cage. — The Chimango commonly frequents the sea coast, & the borders of lakes & swamps, where it picks up small fish. — Is truly omnivorous, & will [even *added*] eat bread, when thrown out of a house

MS. 38

with other offal ; [& *del*] I was | assured, that in Chiloe, they materially injure the Potatoe crops. by stocking up the roots when first planted. In the same island, I myself saw them, by scores following the plough & feeding on worms & larvae of insects. — I do not believe they ever kill birds or animals ; they are more active than the Carranchas, but their flight is heavy ; I never saw one soar. — are very tame, — are not gregarious — commonly perch on stone walls & [trees *del*] posts [added & not upon trees. — frequently utter, a gentle, shrill scream.] [*End of large bracket J*.]

Caracara (1882)

L

(1932.33). — N. Zelandae. —

[*Beginning of large bracket* L.] [[This bird is exceedingly numerous over the whole of the Falkland Islands. — I am informed by the Sealers, that they are found on the Diego Ramirez rocks & the Defonson isles,[3] but never on the mainland of Tierra del Fuego. — Nor are they found on Georgia or the more southern Islands. — It appears, that in this part of the world, the Caracara N. Zelandae, has, doubtless for some good cause, chosen the Falklands for its metropolis. In many respects, this Caracara resembles in its habits the Carrancha ; they live [chiefly *del*] on the flesh of dead animals & marine productions ; in the Il Defonso Isds & Ramirez rocks, their whole sustenance must depend on the sea ; They are extraordinarily tame & fearless & haunt the neighbourhead of houses for the offal ; if a [hunting *added*] party kills an animal, a number soon collect & patiently wait [sitting *del*] standing on the

MS. 38(a) *verso*

ground on all sides. (a) After eating, the uncovered craw is largely protruded, giving to the bird a disgusting appearance. — They readily attack wounded birds ; a cormorant in this state having taken to the

[1] " further south, at Port Desire & the valley of S. Cruz. (♀ in Patagonia is it not rather a small variety 1772 ?) " [lightly deleted].

[2] Altered from : " I have already said it feeds on Carrion together with the Carrancha."

[3] Diego Ramirez rocks are about 100 kilometres south of Cape Horn, and the San Ildefonso islands further west.

shore, was immediately seized on by several [of] these birds, who by blows tried to hasten its death. — The Beagle was at the Falklands |
MS. 39 only during the summer, but the officers of the Adventure, who were there in the winter, mentioned many extraordinary instances of their boldness & rapacity — the sportsmen, on shooting excursions, had difficulty in preventing them seizing the wounded geese, before their eyes ; they actually pounced on a dog which was lying close by fast asleep. — It is said that several together will wait by the mouth of a rabbit hole, & when the animal comes out, will together seize on him. Constantly they flew on board the vessel lying at anchor in the harbor ; & it was necessary to keep a [constant watch *del*] good look out, to prevent the hide being torn from the rigging, & the meat or game from the stern. These birds are very mischievous & inquisitive ; they will pick up almost anything from the ground ; a large black glazed hat was carried a mile, as was also the Bolas, or pair of balls used in catching cattle. Mr. Usborne experienced during his survey a more severe loss, in a small Kater's compass in a red Morocco leather case, which was never recovered. — These birds are moreover quarrelsome & very passionate, tearing up the grass with their bills in their rage. Are not truly gregarious ; flight heavy, clumsy, do not soar ; on the ground run with extreme quickness very much like a pheasant ; The Gallinazo runs in the same manner. They are noisy, uttering several sorts of harsh crys ; one of which is [very *del*] like that of the English rook. — Hence the Sealers always so call them. — It is a curious circumstance |
Maldonado that when crying out, they throw their heads upwards & backwards
MS. 40 after the same fashion as the Carrancha. They build on the rocky cliffs on the sea coast, but only in the small islets & not in the two main islands ; this is an odd precaution in so tame & so fearless a bird. The Sealers say the flesh of these birds is very good to eat, & when cooked
L quite white. —] [*End of large bracket* L.] Specimen (1932) (unfortunately injured) [*added later*] agrees with the specific description in the Dic : Class : legs & skin about beak bright " dutch Orange " beak " ash grey ": thighs rufous &c &c ; female ; eggs in Ovarium size of goose shot ; — Specimens with legs, plumage, &c coloured as the description in Dic : Class : are in *extremely small proportion* to some others ; Specimen (1882) is one such, this however appears to be a young bird [feathers growing ; *added*] there are however others (of which Capt. F. R. [*FitzRoy*] & Mr. Bynoe have specimens) colored precisely in the same way, differing only in proportional length of wing feathers & in the skin about the beak being quite white [& beak itself nearly black
MS.40(a) *added later*]. (a) There is a specimen of the wing, of what I consider the
verso old cock bird. — The Gauchos (who are excellent practical naturalists) state that all the yellow legged rufous thighs specimens are females (which agrees with the one dissection) & all the grey legs males : It

must moreover be remarked that the latter are smaller in size than the yellow legs. — Specimen (1933) is remarkable, bones were rather soft, but feathers complete ; is, like to the old female in being of larger size ; thighs & under parts of wings partly rufous, feathers of neck same shape ; [as in old female ; *added later*] back blacker ; tail without bands ; soles of feet slightly yellow, legs ash-coloured ; skin about beak, with yellow
MS. 41 margin ; beak lower | mandible grey. upper black & grey. — generative organ quite smooth. — I think from this description there can be little doubt but that this was a young female. — 1932 old female. — 1882 young male & Capt. F. R. old male. — It must be observed this will account, (& I see no other way) for the very small numerical proportion of the yellow legs ; a fact which at first to me was most perplexing. — These circumstances appear to me very curious. — I have omitted to remark that (1933) ♀ must be more than one year old, being shot in Autumn. (April corresponding to October) & clearly not that years bird : it is probable they do not attain full [size *omitted*] at least till two years old. — Naturalists appear to have considered all the grey-legs as young birds.

Caracara (2029). (Raucanca ?)

Specimen female ; I do not believe the male is essentially different in its plumage, for I saw several pair[s] such as this together. — Skin about the beak yellow, bill blue, with black lines ; legs pale yellow. — This bird was shot near the last at S. Cruz ; Lat 50°. in Patagonia, it was there very rare, but following up the river I saw several of them. On the West coast I never saw another specimen, & it was with a good deal of surprise, that in Northern Chili (Lat 30°), in the deserts, which extend between Coquimbo & Copiapo I again saw this bird. — I do not believe they are ever in Chili seen South of Coquimbo ; they were in no part numerous, but mostly so in the valleys of Guasco & Copiapò. — This handsome bird, — from what little I saw of its habits, appears to resemble the Carrancha ; it is however much shyer : is generally seen in pairs. — At S. Cruz I saw it with the other Caracaras, waiting till the Condors had finished their feast on a carcase. — |

MS. 42

Caracara. (3297. 3298)

I have never seen this bird anywhere but in the Archipelago of the Galapagos, where it is excessively numerous. — These islands, consisting of a pile of recent Volcanic rocks, are extremely arid & sterile ; the soil is almost everywhere covered by thin leafless underwood. In their ornithology are evidently connected with S. America, although 500 miles from the nearest shore ; they are situated under the Equatorial line : — This Caracara, in most of its habits resembles the C. N. Zelandae ; it is extremely tame & fearless ; frequents houses ; when in the woods a Tortoise is killed, these birds directly congregate, & remain waiting on the surrounding lumps of lava or stunted trees till their feast com-

mences. — They will eat, almost anything, are said to kill chickens & young doves, & are very destructive to the little Tortoises, when they first leave the shell. Flight neither elegant or swift ; but on the ground possess like the C. N. Zelandae the power of running quickly. are noisy, utter many different crys, one very like that of the C. chimango. — Build in trees. — Specimen (3297) is Cock bird ; & 3298, young female ; Mr. Bynoe has old female, (with eggs in ovarium very large) ; these latter may be known, by their breasts being a much darker brown. — Exactly as in the Falkland Isd. these old females are in very small proportion to the others. At the tents, one day I think 30 were counted on the neighbouring hill & bushes, without one with the dark brown plumage. These birds were then (October) beginning to lay ; therefore specimen (3298) must have been at least one year old. — |

MS. 43

Caracara

B To conclude with the foregoing birds ; however they may be arranged from external characters ; they all (B) possess one family air, and[1] agree in habits with the Vultures in the following respects ; in living chiefly on the flesh of dead animals ; in quickly congregating at any spot, where an animal may have died ; in gorging themselves till their craws protrude ; in their tameness, or boldness with respect to mankind, but cowardice to other animals. They are allied to true hawks. in venturing to attack young or wounded birds, — However they may be ranked, they supply to S. America in the economy of Nature the place of the Crows. Ravens. Magpies &c of England. —

Vultur aura. (1915). female. —

This bird has a wide geographical range ; is found in T. del Fuego, on the mountainous western coast of Patagonia, (but not on the dry plains of Eastern Patagonia) in Chili, where according to Molina, it is called Jote, & in Peru, at least as far as Lima. — Differently from the Caracara vulgaris & chimango it has found its way to the Falk-

M land Islds. — [*Beginning of large bracket* M.] [It may be at once recognised at a long distance, by its lofty, soaring, most elegant flight.

MS. 43(a) *verso* (a) They are solitary in their habits or at most go in pairs.[2] It is well-known to be a true carrion feeder ; on the west coast of Patagonia amongst the thickly wooded islets & broken land, it must live exclusively on what the sea may throw up & on dead seals ; wherever a herd of these animals are sleeping on the rocks, there may be seen these Vultures.]

M [*End of large bracket* M.] In the Falklands this bird is tolerably common. — I may mention that at Port Louis, not having seen any of these birds for some days, one morning a considerable number appeared,

MS. 44 so as to lead one to suppose they move | in bodies. They were here

[1] " possess one family air and " added as note B on separate page.

[2] " They are solitary in their habits or at most go in pairs." Added as note (a) on reverse of page. The " a " in script and margin is lightly crossed out, but not the note itself.

shy. — In this female specimen, skin of head scarlet & " cochineal red " iris dark coloured. —

Cathartes atratus. or Gallinazo. —

This bird differs from the last species, in never, as far as I have seen going to the Southward of 40°. — It prefers a humid climate or rather the neighbourhead of fresh water ; it is abundant in Brazil & la Plata. On the [dry & *del*] arid plains some way South of la Plata they never are seen, but nevertheless reappear on the banks of the Colorado. They extend across the Pampas, to the foot of the Cordillera, but, in Chili, I never saw or heard of one, although in Peru it is well known they are preserved in the streets as Scavengers. [*Beginning of large bracket* N.]

N [These birds may certainly be called gregarious ; they seem to have pleasure in society, & are not solely brought together by the attraction of a common prey. On a fine day a flock may often be seen at a great height ; each bird, wheeling round & round, without closing its wings in the most graceful evolutions. This is clearly done for sport-sake, without any further end, without it is connected with matrimonial

N alliances. —] [*End of square bracket* N. *Note* (*a*) *added on reverse of*

MS. 44(a) *page, 44a, and lightly deleted.*] On the ground, they can run very quickly

verso after the manner of poultry in a farm yard. —

Condor[1] The Condor is well known to have a wide geographical range, being found on the west coast of South America from the St of Magellan through-

[1] The pages on the condor are amongst the most corrected and recorrected of any in the Ornithological Notes, with a duplication of p. 46 in the MS. The bird had captured Darwin's imagination, so that not only the range of its distribution, life history and habits are discussed, but its powers of sight and smell are examined on his own and others' evidence. There are two major deletions, themselves heavily corrected. Notes 44 (a), and 45 (a), given above in the main text are the final states of the original writing ; I give here as a footnote the first deleted drafts for comparison.

MS. 44, " On the shores of Patagonia the most northern point, where I either saw or heard of these birds [their presence *del.*] was at the steep cliffs near the mouth of the R. Negro in Lat 41°. At this place they have wandered, about 400 miles, from their |

MS. 45, " most congenial habitation, of the Cordillera ; [in the Andes. *del.*] At St. Joseph's bay I saw a pair sitting on the edge of the sea cliff "—not deleted, but not included in final texts. " Again further South at Port Desire, at the head of the deep Bay, where the rocks of Porphyry form bold precipices we see the Condor, of which a few stragglers occassionally visit the sea, coast. At the mouth of the S. Cruz, there is a line of cliff, frequented by these birds ; following the course of the river inland, at about 80 miles distance, the sides of the valley are formed by precipices of basaltic lava ; Here immediately the Condor appeared in numbers, although, in the space intermediate between these and the sea cliffs, not one had been seen. From these facts, & from not seeing the Condor, in other parts of the coast, where there are not precipices, it would appear that the presence of this bird is here partly determined by the occurrence of such mural precipices." End of first major deletion.

It is of interest to note that the lines of enquiry Darwin followed up later in the *Journal of Researches* and in the *Zoology of the Beagle*—and in his evolutionary work—often found their germinal suggestion in the small pocketbooks he carried with him on his inland expeditions. On the boat journey up the valley of the S. Cruz river, under the date April 23rd, 1834, is the entry : " Condor is present solely where mural escarpments." In September, 1834 he wrote : " Have seen but few Condors — yet this morning 20 together soaring about. Man said at once probably a lion . . . " In July, 1835 he notes : " Smelling properties discussed of Carrion Crows, Hawks. Magazine of Natural History.". Again in July, 1835, he observed their flight : (See second deletion). " Condors flight, close wings — remarkable motion of head & body — "

out the [whole *del*] entire range of the Cordillera. (a) On the Patagonia shore, the steep cliff near the mouth of the Rio Negro in Lat 41°. was the most northern point where I ever saw these birds or heard of their existence. They have here wandered about four hundred miles from the great central line of their habitation in the Andes. Further south
MS. 45(a) also, amongst the bold precipices which form the head of [the deep creek of *del.*] Port Desire they are not uncommon ; yet [but only *del.*] a few stragglers occasionally visit the sea coast. A line of cliff near the mouth of S. Cruz is frequented by these birds, and about eighty miles up the river, immediately that the sides of the valley [are *del.*, were *del.*] are [*replaced*] formed by steep basaltic precipices the condor [as I have already said *del*] is again found, although in the intermediate space not one had been seen. — From these [and similar *added*] facts, [and from the absence of the Condor in some other parts of the coast, where the land was not abruptly broken, *del*] the presence of this bird appears to be chiefly determined by the occurrence of perpendicular cliffs. |

MS. 45 In Patagonia the Condors, either by pairs, or many together, [collectively *del*] both [nightly *del*] sleep & breed on the [same *added*] overhanging ledges. — In Chili however, during the greater part of the year, they haunt the lower Alpine country [of *del*] nearer to the shores of the Pacifick, & at night, several [together *del*] roost in one tree ; but during the early part of summer they retire to the most inaccessible parts of the inner Cordillera, there [(as it is said) *del*] to breed in peace. . — With respect to their propagation, I [am *del*] was told by the country people of Chili, that the Condor makes no sort of nest, but [in the months of November & December *added*] lays two large white eggs on a shelf of bare rock ; at S. Cruz & P. Desire, in vain I tried to discover [find *del*] the nest, amongst the cliffs, where the young ones were then
MS. 46 standing. | I am assured the young Condors cannot fly for the first whole year. — At Concepciòn, on March 5th [corresponding to our September *added*] I saw a young Condor, which in size, was but little inferior to an old bird, but was covered over its whole body by down [precisely like that of a Gosling — excepting in being *del.*] of a blackish colour, but otherwise just like that of a gosling. — I feel sure, this bird could not [would not have been able to *del.*] have used its wings for flight, for many months. — After the period when the young birds can fly & apparently as well as the old ones [birds *del*] it would appear, from what I more than once observed [in Patagonia *added*] that they yet remain, both roosting at night on the same ledge [of rock *del*] & by day hunting, with their parents. — Before however the ruff round the neck [s *del*] of the young bird [s *del*] is turned white, [they *del*] it may often be seen [independent *del*] hunting by itself. At the mouth of the S. Cruz, during a part of April & May, two old birds every day were either perched on certain ledges, or sailing about with a single young bird, which

though full-fledged, had not its ruff white. [*altered from* : . . . young bird, full-fledged; but the ruff not white.] I can feel no doubt, especially when recollecting the state of the Concèpcion bird [only one month previously *added*] that this young Condor had not been hatched from an egg of the same summer. And as there was no other young bird, it seems [is *del*] probable that the Condor only lays once in two years.[1] (?) In Patagonia, these birds, generally [very frequently, as I have said *del*] live by pairs ; but amongst the inland basaltic cliffs, I found a spot [place *del*] where scores must usually haunt ; on coming suddenly on
MS. 46(a) the brow of the precipice, (a) it was a fine sight to see between twenty or thirty of these great birds start heavily from their resting place, and then wheel away in majestic circles. — [*Corrected from* : — upwards of
MS. 46XXX twenty took flight & magnificently soared away.] | From the quantity of dung on the rocks, they must long have frequented this cliff [spot *del*] & probably they both breed & roost there ; — Having gorged themselves [full *del*] with carrion [*added*] on the plains below, they retire to
MS. 47(a) these favourite ledges to digest their food. — (a) From these fact[s] we must to a certain degree consider the Condor, like the Galinazo, a gregarious bird. [*Corrected from* : Hence the Condor must be considered to a certain degree, a gregarious bird.] They are neither shy nor wild ; in this part of the country they exclusively prey on the guanaco, which either have died a natural death, or, as more commonly happens, have been killed by the pumas. — I am inclined to believe from what I saw in Patagonia, [contrary to the common supposition *del*] that they do not on ordinary occasions[2] extend their daily excursions to any great distance[3] from their regular sleeping places. — The Condors, may oftentimes, be seen at a great height, soaring over a certain spot ; in the most graceful spires & circles, on some occassions. I feel sure, they

[1] This question of the reproduction of the condor went through changes in the two editions of the *Beagle*, and again in the *Zoology of the Beagle*. The above passage, with its evidence of the prolonged juvenile state of the young bird, is given in *Beagle*, 1839, p. 220, but is much shortened in *Beagle*, 1845. In *Zool. of Beagle*, 1841, Darwin quotes M. Alcide d'Orbigny as contradicting the statement that the young birds cannot fly for the first whole year. *Voyage dans l'Amerique Méridionale* par A. d'Orbigny, 1835–47. On p. 93, *B.* 1845, Darwin gives in a footnote his appreciation of this work, and says : "When at Rio Negro, we heard much of the indefatigable labours of this naturalist. M. Alcide d'Orbigny, during the years 1825 to 1833, traversed several large portions of South America, and has made a collection, and is now publishing the results on a scale of magnificence, which at once places himself in the list of American travellers second only to Humboldt."

[2] " Occassions " is here corrected by Darwin by crossing out one " s ". This spelling discovery was therefore made whilst he was writing up his condor notes. The double long s is still written in the first drafts wherever " occasion " or " occasionally " occur; but in the later alterations the spelling is correct.

[3] " I suspect in Patagonia " [*altered from* : " I may doubt whether they hunt "] "they do not commonly hunt " [" I seldom saw them " *del*] " at a greater distance than " [more *del*] [beyond *added*] twenty miles . . . " this many times corrected passage was finally deleted.

do this for their sport, but on others, the Chileno countrymen will tell you, that they are watching a dying animal, or the puma devouring its prey: If the Condors glide down, & then suddenly all rise together, the Chileno knows that it is the puma which still watches the carcase & has sprung out to drive away the robbers. — Besides carrion, the Condors frequently attack young goats & lambs; hence the shepherd dogs are trained the moment the enemy passes over to run out, and looking upwards to bark violently.[1] The Chilenos destroy & catch
MS. 47 numbers; | two methods are used, one is to place a carcase within an enclosure of sticks on a level piece of ground, & when the condors are gorged by galloping up on horseback to the entrance thus to enclose them. For this bird, not having space to run, cannot give its body momentum sufficient to rise from the ground. — The second method is to mark the trees in which they roost, frequently to the number of five or six together, [*corrected from*: in which the Condors frequently to the number of five or six together, roost,] & then at night climb up & noose them; they are such heavy sleepers, as I have myself witnessed, that this is noways a difficult task. — At Valparaiso, I have seen a living Condor sold for sixpence, but the common price is eight or ten shillings; — One which was brought in, had been lashed with rope & was much injured, but the moment the line was cut by which its bill was secured, it began, although surrounded by people, ravenously to tear a piece of carrion. — At the same place in a garden, between twenty & thirty were kept alive; they were fed only once a week &
MS. 47(a)* *verso* appeared in pretty good health. (a)*[2] I noticed [& was told it was of general occurrence *inserted*] that several hours before any of the Condors die; all the lice with which they are infested crawl to the outside [of the *del.*] feathers. — [Ricinus (2153). — *del.*]
The Chileno countrymen [Guassos *del.*] assert, that the condor, will live & retain its powers, between five & six weeks! [without eating *added*] I cannot answer for the truth of this, but it is [a likely enough although *del.*] a cruel experiment, which very likely has been tried.

When an animal is killed in the country, it is well known that the Condors, [altered to condors] like other Carrion [altered to carrion] vultures, gain the intelligence & congregate in an inexplicable manner. In most of these cases, it must not be overlooked, that the birds have
MS. 48 discovered [collected *del.*] their prey and | have picked the skeleton clean, before the flesh could have been in the least tainted. Remembering the opinion of M. Audubon on the little smelling [olfactory *del.*]

[1] Corrected from: "hence the shepherd dogs are trained to run out & bark violently upwards, the moment the enemy passes near."

[2] The asterisk in the text indicates that Note 47(a) was to be given as a footnote in the Journal. See *B.* '39, p. 222, and *B.* '45, p. 184. The form is slightly altered; "I was assured that this always happened." comes at the end, and "Ricinus" and the number are omitted.

powers of such birds, (b)*[1] I tried, in the above mentioned garden, the following experiment. The condors, were tied, each by a rope, in a long row at the bottom of a wall. — Having folded [folding *del.*] a piece of meat in white paper I walked backwards & forwards, carrying it in my hands, at the distance of three yards. No notice was taken, I then threw it on the ground within one yard of an old cock bird, he looked at it but took no further notice. — With a stick I pushed it [still *del.*] closer ; [& closer, *added*] the Condor [at last *added*] touched it with his beak, & then instantly with fury tore off the paper. at the same moment, every bird in the long row was struggling & flapping its wings. Under the same circumstances, it would have been out of the question, to have deceived a dog. | (a) I may remark, that it has often happened to me, when lying down to rest on the open plain, [country *del.*] that on looking upwards I have seen carrion hawks, sailing through the air at a great height. Where the country is level [commonly *del.*] I do not believe, a space of the heavens of more than 15° above the horizon is commonly viewed [beheld *del.*] with any attention, by a person either walking or on horseback. If such is the case & the Vulture is on the wing at a height of between three and four thousand feet, [*altered from figures*] before it could come [would fall *del.*] within the above range of vision, its distance in a straight line from the beholder's eye would be rather more than two British miles. — Might it not thus readily be overlooked ? When an animal is killed by the sportsman in a lonely valley, may he not all the while be watched from above by the sharp-sighted bird ? And will not the manner of its descent, proclaim throughout the district to the whole family of carrion feeders, that their prey is at hand ? [*The following passage is scored through by two vertical lines, but I give it in the main text as it contains material not given elsewhere.*] Amongst all these Condors, I noted the following circumstance, that the hens have bright red eyes, but the cocks yellowish brown. In a specimen, which at S. Cruz, I knew

MS. 48(a) *verso*

[1] The asterisk again indicates a footnote for the Journal. In *Beagle* '39, 222, the footnote is taken almost verbatim from note MS. 48(b), which reads as follows :

(b) " In the case of the Vultur aura, Mr. Owen, in some notes read before the Zoological Society, has demonstrated from the developed form of the olfactory nerves, that this bird must possess an acute power of smelling. It was mentioned on the same evening, that on two occasions, persons in the West Indies having died & their bodies not being buried, till they smelt offensively, these birds had congregated in numbers on the roof of the house. This instance appears quite conclusive as it was evident they had gained the intelligence by the powers of smell, and not of sight." [*Altered from* : " In this instance vision could not have helped . . . "] " It would appear from all these facts, that carrion feeding hawks possess both the sense [*altered from* power] of sight and smell in a high degree." End of MS. 48 (b).

In *Beagle* '45, p. 185, the discussion is given in the main text, as Darwin had received further evidence against the acute sense of smell of the turkey-buzzard and gallinazo. The date of Owen's communication to the Zool. Soc. was 14th March, 1837, and Darwin was present. Owen's information about the olfactory nerves of the vulture was given in a letter to Mr. Yarrell, the secretary. It ends : " The above notes show that the vulture has a well-developed organ of smell ; but whether he finds his prey by that sense alone, or in what degree it assists, anatomy is not so well calculated to explain as experiment."

The date of the meeting proves that Darwin added note MS. 48(b) to the main text after March 1837.

by dissection to be a female the same color was observed. A young bird (which however, it being Spring-time, must have at least been one year old,) whose back was still brownish & ruff not white, had its eyes *dark* brown ; upon dissection after death, this young bird turned out to be a female. — The young male has its back & ruff brown & the comb on head simple. — It is rather singular, that in Chili, the old birds, are
MS. 49 known amongst | the country people, by the name of " El Buitre " or the Vulture ; whilst those alone, without the white ruff, are called Condors. — Molina says that the proper Indian name is Manque. [*End of scored passage.*][1]

When the Condors in a flock are wheeling round & round any spot, it is beautiful to observe the manner of their flight. Excepting when rising from the ground, I do not recollect ever having seen one flap its wings. Near Lima I watched several of them, for quarter & half an hour, without once taking off my eyes ; they moved in large curves, sweeping in circles, descending & ascending without once flapping. [flapping, *del* ; closing their wings, *del* ; flapping *added.*] As some of them glided close over my head, I intently watched, from an oblique position, the separate & terminal feathers of the wing ; if there had been the least vibratory motion, the outlines would have been blended together, but they were seen distinct against the blue sky. The head & neck were moved frequently & apparently with force ; & it appeared [would *del.*, seems *del.*] as if the extended wings formed the fulcrum on which the movements
49XXX of the neck, body, & tail acted. | [*Insertion XXX*] If the bird wished to descend, the wings were for a moment collapsed ; and then when again expanded with an altered inclination, the momentum gained by the rapid descent, seemed to urge the bird [body *del.*] upwards, with the easy and steady movement of a paper kite. In the case of any bird soaring, it must have sufficient rapidity of motion, so that the action of the inclined surface of the body on the atmosphere may counterbalance its gravity. The force to keep up the momentum of a body moving in a horizontal plane in that fluid (in which there is so little friction) cannot be great, & this force, is all that is wanted. The slight movements of the neck and body of the condor we must suppose sufficient for this. [*Altered from* : Must not the slight movements of the neck and body of the condor be sufficient for this ?] However this may be, it is truly wonderful and beautiful to see so great a bird, hour after hour, without any apparent exertion wheeling and gliding over mountain and river.[2] —

[1] See *History of Chili* by the Abbé Don J. Ignatius Molina, 1809, Vol. I, p. 220.

[2] The remainder of MS. 49 and all of MS. 49 (a), have rough drafts for the above inserted passage on p. 49XXX, which remains with very slight alterations in *Beagle* '39, p. 223, and in *Beagle* '45, p. 186. I give the deleted rough drafts here ; the last phrase, on the bird taking advantage of all air-currents, sounding so familiar to our more air-minded ears, is not found in the remodelled version. " . . . these movements happen in a perpendicular as well as in a lateral direction ; by the former the inclination of the whole extended surface of the bird, with the horizon, is at once altered ; this, acting with the

[*End of insertion XXX*. The writing can just be discerned here through a huge blot.] |

MS. 50 I will here add a few trifling observations on some well known birds at
N.B. the Falkland Isds. —

M. Lesson states, that three sorts of Penguin are found amongst these Islands. Capt. FitzRoy has a fourth species, which I have seen also in the St. of Magellan.

Penguin One day I was much amused by watching the manners of P. demersa, having placed myself between it & the water. — It is a brave bird ; till reaching the sea he regularly fought & drove me backwards. Nothing less than [a] heavy blow could have stopped him ; every inch gained he kept, standing close before me, erect & determined. — When thus opposed, he continued to roll his head from side to side ; as if the power of distinct vision lay in the anterior part of the eye, and only in a plane, horizontal with respect to the usual position of the head. [bird *del.*] This bird is called the Jackass Penguin, from when on shore, throwing its head backward & making a loud strange noise, very like the braying of that animal. When at sea, & undisturbed, its note is very deep & solemn, & is often heard in the night time. When diving it uses its little wings with great rapidity ; and when on shore, crawling through the tussocks or on the side of a grassy cliff, it likewise uses them as front legs. — In such situations its motions are so quick, as to resemble in a singular manner, some small quadruped. — On the open ocean, this bird with its low figure, its easy motion & crafty appearance, may be likened to a Smuggler. —

Steamer A logger headed duck, called by the old navigators race horses, and now steamers, has often been described from its extraordinary manner of
MS. 51 splashing & paddling over the water. | They here abound in large flocks. In the evening when preening themselves, they make the very same mixture of noises, which bull-frogs do within the Tropics. — Their heads are remarkably strong, so much so, that actually I had difficulty in breaking it with my heavy geological hammer : the beak is possessed of corresponding strength ; a structure which must well fit them for their mode of subsistence ; this judging from their dung must almost exclusively consist of shell fish obtained from the Kelp, & from the shores at low water. They enjoy but little power of diving. They are extraordinarily [(as all our sportsmen can testify) *del.*] tenacious of life,

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momentum gained by a rapid descent, appears to cause the bird to rise, like a paper kite, with an even & steady motion. In case of a Condor soaring, the bird must have sufficient rapidity of motion, so that the action of the inclined surface of the body on the atmosphere may counterbalance its gravity — The force to keep up the momentum of a body moving in a horizontal direction in that fluid (in which there is so little friction) cannot be great ; This force is all which is wanted : — must not the movements of the neck and body be sufficient ? The bird also doubtless takes advantage of all currents in the air. — "

A further version of the early section is given on p. 49 a. " In the midst of a rapid descent it will thus alter the inclination of its extended surface, & this acting with the acquired momentum, seems to force its whole body to rise, with an even and steady movement like that of a paper kite. "

& as all our sportsmen can testify, very difficult to kill. — Mr. Stokes once shot one, near Chiloe which weighed 22 lb. — Trachea (545) Spirits.

Goose MS. 51B *verso* — The Upland goose is common in pairs. & Small flocks of half a dozen; throughout the island. (B). Trachea in spirits (904) & (576.577 Cock & Hen). — N.B. Trachea. (& worms from stomach of Diomedia exulans (817). — They do not migrate, but build on the small outlying islets; this is supposed to be from fear of the Foxes, & it is perhaps from the same cause, that these geese, though exceedingly tame by day, are shy & wild in the dusk of the evening. — It lives entirely on vegetable [matter] and is very good eating. —

Goose (rock) — The rock goose (Anas hybrida of Molina) is common here, in T. del Fuego, & on the west coast as far as Chiloe. These birds invariably go in pairs. — In the deep & retired channels of T. del Fuego, the snow white Gander & his darker companion, standing close by each other, on a distant rocky point, form a marked feature in the landscape. —Trachea

MS. 51(a) *verso* — (508) in Spirits | (a) This goose lives & feeds exclusively on the marine productions of the shore.

1834 — The black-necked swan is an occasional visitant to the Falklands. — |

S. Cruz. Lat 50°.

MS. 52

2004 — Feathers of Avestrus Petise, high up S. Cruz. Vide infrà

2011 cop — Callandra. — see suprà. No ? (1216). — S. Cruz

2012 cop — Lanius; rare [unless ? *del.*] both on coast & in the interior plains; chaces insects very quickly half flying, half running. — do

2013 cop — Lanius. — rare. — female. — Hab. do. — N.B. One of these birds is brownish with a white tail; I saw it in the lofty & arid valleys on the Eastern slope of the Cordillera at Chili. — The other of these, or one shot at P. Desire or St Julians, is brown all over & with a broarded[1] bill like true Lanius, this bird is found also in Chili as far North as Copiapò. I am assured that it commonly kills young birds. —

2014 cop — Hawk. female, flutters stationary over a spot like the Kestril; wide range, being found on the west coast as far as Lima. — S. Cruz

2015 — Fringilla (cock ?), frequent the bushy valleys in small flocks from six to ten, are not common. — I only saw them in one other part of Patagonia at St Julian's Bay. — They utter a very peculiar & pleasing note; sometimes they move from bush to bush with an odd soaring flight. — I saw this bird in the valleys of the Cordillera of central Chili, at height which must have been about 8000 ft. near to the upper limit of vegetation. — (B) [*added on reverse of page*] & rarely in the low country of Chili.

[1] Probably intended for " broader ". The extra r in broad, neighbourhead for neighbourhood, besides the long double s in occasion and occasionally, were amongst the constant early spelling mistakes when writing his Diary during the voyage. In the last of the small pocket books (See *Beagle*, 1945, p. 252,) Darwin lists the needed purchases in the next town,—probably Cape Town, for use in the last lap home. These include "12 of the little Quires from the Captain—Inkstand, pencils, Blotting paper. Bramah pens, common do." Also a spelling Dictionary. These acquisitions prove how occupied he was in writing up his notes whilst still on board. See *Diary* 1933, p. XIX.

2016 do. — female. Hab. do.

2017. Fringilla. — Cock — abundant in valleys near coast & in the interior country. — Hab. do. S. Cruz.

2018 do. — female — do.

2019. Fringilla cock — rare — do.

2020 (a) Red throated creeper male ; MS. 52(a) *verso* In the lofty, arid valleys of the Eastern slope of the Cordillera of central chili his bird is found. — N.B. (I call these & following birds creepers, without meaning to say, they have habits of *true* creepers ; they hop actively about the thickets & herbage of the most wooded but sterile valleys.)

MS. 53 N.B. *S. Cruz* When I call these small birds males, I do so because | the generative organs, even with aid of lens did not appear granulated. Anatomists will know how far this is subject to error. —

2021 cop Creeper not uncommon, amongst the thickets

2022 cop Creeper (long tailed) : male : do. S. Cruz

2023 cop — —

2024 cop Creeper ; male : — do —

2025 cop (a) Furnarius. — female. — not common : flies about under the bushes, & cocks up its tail ; quickly reiterated cry do

MS. 53(a) *verso* Is found on Eastern Cordillera with Creeper 2020 V.

2026 cop Wren. — female. — harsh chirp. —

2027 cop. Parus : female : by three's & four's together. — do

2028 cop Caracara Vide page 34, genus — do

2029 cop Caracara : female of Caracara — do

2030 cop Hawk legs pale yellow, bill blueish black — do

2031 cop Owl. — do

2080 Procellaria gigantea. Called by the English Nelly & by the Spaniards Quebranta huesos. — This bird was shot in Port Famine ; I had long marked this black variety & thought it a different species. — But Mr. Lowe[1] (a person who for many years has from his business, been intimately acquainted with all these southern countries & their productions) assured me that it is the young of the common greyish black kind. — Besides the well marked distinction of color, the flight of this kind appears to me more elegant. Bill wax white ; legs black, upper surface greyish. The Nelly is common over all the southern latitudes : she frequents the deep inland channels as well as the open ocean far from the coasts. Often settles & rests on the water. — In their flight & general appearance on the wing much resemble the albatross, & as they

MS. 54 commonly frequent the same | parts of the ocean, it is probable their food is nearly similar. But in the case of either [both *del.*] bird, it is in vain to watch [them *del.*] to discern [?] on what they feed ; [*added*] they

[1] " Sunday [March] 24, 1833 . . . On Friday a sealing vessel arrived commanded by Capt. Lowe ; a notorious & singular man, who has frequented these seas for many years & been a terror to all small vessels." Quotation from *Beagle Diary*, 1933, p. 141. Darwin had great faith in Lowe's observations.

appear to hunt the water in sweeping circles for days [together *added*] without [being seen to *added*] catch any prey. — The Nelly is carnivorous; some of the officers of the Beagle, at Port St Antonio, saw one pursue & kill a species of Coot. The latter tried to escape, both by diving & flying; but was continually struck down. — at last its fate was concluded, by a blow on the head, when rising from beneath the water. At Port St. Julians the Nelly was seen to kill young gulls. — This specimen, had in its stomach the bill of a large cuttlefish. — The Nelly breeds on the coast of Patagonia, on small islands, such as Sea Lion's Isld at S. Cruz. — The following notes may help to serve as comparison with the above specimen; is description of one killed at Maldonado, Rio Plata; appeared slightly to differ in colour from description of " gigantea " in (Manuel. d. o ?)[1] colour " greyish black ", a shade darker above & one lighter beneath. — Extreme points of Tarsi (measured outside) 3·4 inch. — Fibulae, from centre of articulations 10·8. — Lower mandible from feathers to extremity 3·15. — Nose, measured on central part, from a membrane at base to concavotruncate extremity 1·65. — Depth of bill including nose 1·2 — retrices 16 in number. —

2081 cop MS. 55 Tyrannus; not uncommon, Port Famine; is found on west coast as far North as Copiapò in Northern Chili; sits generally perched on a moderately high twig looking out for its winged prey | Builds a coarse nest in bushes: egg (2375: iris scarlet: Specimen from Chiloe (2124). —

2082 Fringilla, in small flocks, feeding near the beach, — I never saw any before. — I do not believe the cocks (if this is not one) are brighter coloured. — Port Famine. June

2083 cop Tyrannus — do —

2084 Certhia. — Probably of all land birds in T. del Fuego, this is the most numerous; it is likewise common on whole wooded coast of the west, & is found even as far North as 60 miles south of Valparaiso, but there the dry country & stunted woods are not favourable to its increase. In T. del Fuego, throughout the forests of Beech trees, both high up, & low down in the most gloomy, wet & impenetrable valleys, this little bird is common. Its numbers no doubt appear the greater, from its habit of following, with apparent curiosity, every person, who enters these silent forests; continually uttering a shrill harsh twitter, it flutters from tree to tree within a few feet of his face. — It is far from wishing for the modest concealment of Certhia familiaris. — Nor does it, but seldom, run, like that bird, up & down the bark of trees, but, industriously, more after the manner of a willow wren, hops about & searches every twig & branch. —

2122 cop Alcido. female. This bird is abundant in T. del Fuego, in la Plata (Brazil ?) & Southern Chili. This specimen came from the island of Chiloe: its habits generally resemble those of the Europaean kind;

[1] Refers to M. Alcide D'Orbigny's Manuel.

MS. 56[1] but both here & in Tierra del Fuego, its | common, if not universal places of resort, are the quiet coves & deep creeks of the sea. — In the stomach of this bird was a Cancer brachyurus & small fish. — I may here also add, that amongst the Chonos Islds Mr. Bynoe, shot a large eared Owl, the stomach of which was full of Decapod Crustaceae ! — Chiloe

2124 cop Lanius vide. (2081) do

2125 cop Turdus : male : this bird is found whole west coast. (la Plata ? [*added in margin*] Falkland Isd & in Chili to its Northern limits, is very common — feeds chiefly on seeds & berrys. Is said to have its nest smoothly lined with mud. I presume like our thrush. do

2126 cop Furnarius : male ? : Chiloe

2127 cop Myothera ; (female) called by the Chilotans, Cheucau. — is common in Chiloe, extends at least as far as 47° South, but further North than 37°, where the woody country ceases, it has not been seen. — This bird frequents the most gloomy & retired spots in the humid forests. At some times, although its cry may be heard, it cannot with the greatest attention by seen ; but generally by standing motionless, in the wood, it will approach within a few feet, in the most familiar manner. It busily hops, its tail vertically cocked upwards, amidst the impervious mass of rotting canes & branches. The gizzard is muscular, it contained, hard seeds, buds of plants & vegetable fibres, mixed with bits of stones ; in a specimen, killed further to the South, there were also, some scanty remains of insects. It is said to build its nest in low bushes or amongst

Chiloe July sticks close to the ground. — This bird is well known & held in super-

[***1834***] stitious dread, by the natives on account of the strange | & varied crys

MS. 57 it utters : the most usual is a loud singular repeated whistle. — There are altogether three very distinct kinds ; one is called Chiduco & is an omen of good, another Huitreu which is unfavourable. These names are given in imitation of the sounds ; by which the natives are in some things, actually governed ! — The Chilotans have certainly chosen a most comical little bird, for their prophet. — Chiloe

2128 cop Muscicapa ; is here found always on the beach, expands its tail like fan.

2129 cop Creeper : female : runs up & down the trees, manners like Certhia familiaris ; Coleoptera in stomach ; is found as far North as central Chili, but is not there common ; is in Chiloe far from rare.

2130 cop Creeper : female : V (2084)

2131. — Fringilla. — Chiloe. —

MS. 57(a) *verso*

2132 } Fringilla, — cock & Hen, shot together — Is found in numbers from

2133 } Chiloe throughout Chili, at least as far as Copiapo. Was shot at the Rio Negro [*Added in margin*] But, as far as I am aware, has not crossed the Cordillera to the Eastward. In Chiloe it is perhaps the commonest land bird ; in small flocks, it frequents the cultivated ground & neighbour-

[1] Added at top left-hand corner of page " 2123. Chiloe " and some illegible words.

head of houses ; in these respects & general habits very much resembles our sparrow. — In stomach generally seeds & sand. — Specimen (2320) will show its nest & eggs ; it was built on the trellis work of a vineyard in a garden, close by a frequented path, at Valparaiso. During time of incubation the male bird utters two or three pleasing notes, which Molina has exaggerated into a fine song. — Is called in Chili " Dinca ". — I should add, that this bird is not *exclusively* found near houses. — |

Chiloe. July. —
MS. 58
2134
2135

Trochilus (latter female by dissection ?) Is found on the West coast from Northern Chili to Tierra del Fuego, in which country it has been described, as seen sucking the flowers of a Fuschia in the midst of a snow storm.[1] In Chiloe it is exceedingly abundant, perhaps in number of individuals, it is scarcely exceeded by any other bird, excepting the Dinca. — This delicate little bird, uttering its very acute chirp, skips from side to side, amongst the dripping foliage, but it appears out of character in these climates of endless storms. In Chiloe, it commonly frequents open marshy ground, where the *Bromelias* in patches form dense thickets ;[2] on the edges of these, it may be seen hovering, & every now & then dashing into them, near to the ground, but whether it ever actually alighted, I could never observe. There were at this time of year scarcely any flowers, & none whatever, where the above plants grew. Hence I was well assured they did not live on honey ; on opening the stomach or duodenum, in a yellow fluid, by the help of a lens, I plainly saw numerous morcels of the wings of Diptera, probably Tipulidae. It is evident the Humming birds search these insects out of their winter quarters, amongst the thick foliage of the Bromelias. It is truly insectivorous ; In the stomach of one shot at Valparaiso, besides small Diptera, I found [*corrected from* : recognised parts] of Ants ; the contents were like what might be found in a Certhia. — Amongst the Chonos Isd. although at a time, when there were flowers on the outskirts of the
MS. 59
woods, yet the damp recesses of the forest | were the favourite haunts. In the stomach of one shot here, there was a black mass of finely comminuted insects.[3] In central Chili, these birds are said to be regularly migratory. They make their appearance in the Autumn [of the year ; *del.*] the first I noticed was on the 14th of April, but by the 20th

[1] See Capt. King, *Voyage of Beagle* '39, Vol. I : 127.

[2] Note added on reverse of page, 58 (a). " These plants are not Bromelias ; they bear a fruit like a pineapple ; have strong recurved leaves armed with strong hooks ; these spring from a woody stalk. It is called some name like Pophos ? — " Bromelia is mentioned in *Beagle* '39, but omitted in *Beagle* '45. The identity of the plant does not seem to have been determined.

[3] From " on opening the stomach " eleven lines back, MS. 58, one faint vertical, and a few wavy horizontal erasures have been made. Also two crosses in margin. Yet the substance of the passage remains in both *Beagle* '39, pp. 330–331, and, somewhat curtailed, in *Beagle* '45, pp. 271–272. The re-writing of the passages is very considerable, showing that the O.N.s were still only rough drafts.

corresponding to our November, [*added in margin*] at Valparaiso they were numerous. Staying through the winter, in the Spring, they were still very numerous in August, from that time they gradually decreased, so that on Octob. 12th., in a long walk, only a single one was seen. — As this [small *del.*] species disappears, a larger kind arrives, which circumstance will be mentioned with the account of that bird. I do not believe this Trochilus breeds in any part of central Chili, for at the time, when they have migrated from that country, nests were common in Southern Chiloe & in the Chonos Isd. — Specimen (2425) shows nest & egg ; on Decemb. 8th.,[1] eggs nearly Hatched, South end of Chiloe : a little further south in January, young birds. — This case of migration exactly agrees with what happens in N. America. Humming birds are said to migrate to the United States & Canada to avoid the heats of Summer, — Humbd. Vol. V Part I. P. 352. — On the West coast they likewise move in the same direction to Nootka Sound. Cook. 3rd Voyage. Vol II. — Our Trochilus, though migratory in one part, is a permanent resident in T. del Fuego. — In a like manner. Beechey[2] says that the Humming
MS. 60 birds remain in Northern California all winter. — Amongst the | Chonos Islands in January, when there were young birds in the nest, a considerable number of specimens were shot ; amongst these very few or scarcely any had the usual shining head of the Cock bird,[3] yet on opening their bodies, many appeared to be of that sex. Specimen (2503) is in this case ; it may be observed to have a yellow gorge, & I have seen some specimens with light brown feathers on their backs. — Is it a distinct species ? It is certain they cannot be young birds. From the proportional numbers & dissection I do not think they can all be hens, although [birds *del.*] in [*added*] that sex the glittering feathers on the head are never present. Are the cocks moulting ?

Trochilus : (2179 [female *del.*]). (2180 male). —

I saw this bird in the middle of August in Valparaiso : it was stated that it had then shortly arrived, & certainly by the month of September its numbers were much increased. — On the wing its appearance is singular ; like others of the family, it moves from place to place, with a rapidity & manner, which may be aptly compared to that of Sirphus amongst the Dipterous insects. But when hovering over a flower, the motion of its wings is slow & powerful, so as not in the least to possess that vibratory movement, common to most of the species. Hence no humming noise can be perceived. — I never saw a bird, where the force of its wings, as in a butterfly, appeared so powerful in proportion to its
MS. 60(a) *verso* weight. (a) I do not know whether this is intelligible ; each time as it slowly flaps its wings, the body springs back from between the blows. —

[1] This sentence to " young birds " scored in the margin, with a cross.

[2] Frederick William Beechey, 1796–1856, rear-admiral and geographer. President R. Geog. Soc., 1855. Wrote narrative of a Voyage to the Pacific and Beering's Strait ... in His Majesty's Ship Blossom etc, 1825–8, London, 1831.

[3] Cross in the margin.

The expansion of the tail between each flap, appears both to steady & support the bird. — Specimen in Spirits (1050) [*End of Note* (a).] When hovering by a flower, the body is kept in a nearly vertical position,
MS. 61 & the tail is constantly expanded & shut like a fan. — | Although thus flying from flower to flower, yet in its stomach there were abundant remains of insects ; these & not honey must be the object of its search. — Note very shrill. — As I have before said, this Trochilus takes the place during the summer of the smaller species, which migrate to the Southward to breed ; the object of this bird, must be similar, it doubtless comes from the parched northern countries, & certainly uses Chili, as its breeding place. Specimen (2319) is the nest. — In central Chile, this bird is far from uncommon. —

MS. 61B *verso* I may mention that in the Cordillera of central Chili, I saw a humming bird, at the height of about 10,000 feet & a little below the snow line. — I am not sure of the species, but it had, I think, some white feathers about the neck or body. — [1]

2136 cop Hawk. female. — Chiloe — July — [***1834***]

N.B. . . . Besides the birds already enumerated, I saw the Condor, 2 Caracara, Vultur Aura : Hawk 2014 : Furnarii (1822 & 1823) : Wren 1831. Sparrow 1826. — Certhia 2084 — Icterus 1784 abundant, — the black & scarlet headed woodpecker ; of these birds a few generally travel together, very noisy, crys singular, within forest. — Vanellus or Pteru pteru. — Myotherus 2531. — Rhyncops : Myothera 3436. — and many many water birds.

I may remark, that the ornithological character of Chiloe & Tierra del Fuego ; although these countries are separated by twelve degrees of Latitude, their climates are not very dissimilar ; in each, the whole surface is covered, by one gloomy wet, & scarcely penetrable forest. In Chiloe, although situated in so temperate a zone, the woods in some respect partake of a Tropical character. Many different kinds of trees are thickly placed together, on them vegetate numerous parasitical plants, of which not a few are monocotyledenous — an arborescent
MS. 62 grass, or cane, intertwining the trees to the height | of 30 ft, forms extensive & most impervious brakes. Many beautiful ferns, although not tree-ferns, grow to a very large size and are abundant. — [*added as Note* (*a*) *partly on verso of MS.* 61 *from " an arborescent grass."*]

Chile

2147 : 2148. Bones supposed to belong to the Avestruz petise picked up at St. Julian's. —

N.B. The following birds were shot at *Valparaiso*, during months of August & September (***1834***). — The sexes were distinguished by S. Covington by

[1] Note B on the verso of 61, is not given an exact place of insertion on the recto. For reference to Trochilus, see *Beagle*, 1839, MS. 330–332, and *Beagle*, 1845, MS. 271–272, where Note B is left out, and the whole reduced.

opening their bodies, & judging chiefly from the granulated state of the Ovarium : it being the Spring, probably this means is correct. —

2159 cop Partridge : male : In its general habits & appearance very closely resembles the Partridge of la Plata (1223). — namely in its manner of running openly — not readily squatting, — flight — going in pairs — flesh white — &c &c &c. — Nevertheless I am sure it is a different [form *del.*] species, from its whistle, when rising from the ground, being much shriller & of a distinct tone. It is tolerably numerous ; — is not so easily caught, as those in la Plata. I never heard of these being here caught by men on horseback. —

Egg (2427). — An officer on board having some eggs from B. Blanca on the East coast, I carefully compared them. The general color & appearance is similar, being palish " Chocolate red ". The B. Blanca one, a shade paler ; this one is also smaller. —

Diameter	Valparaiso inch	B. Blanca	Difference
Longer axis	2·070	1·815	·255
Shorter do	1,495	1·300	·195
Difference	0·575	0·515	·060

2160 Pidgeon : female : (large kind) —

2161 cop Woodpecker : male : is the " Pitui " of Molina. I think the name must come, from its curious note, which somewhat resembles that word. Frequents the dry hills, over which a few bushes & trees are scattered. . — Molina states that it builds its nest in holes in banks. — Is it same with that of Maldonado ? |

MS. 63

Valparaiso— August & September [*1834*]

2162 cop Owl : male :

2163 cop Dove : female. —

2164 cop Water Hen : male : Bill " grass & emerald green " iris scarlet

2165 cop Water Hen : female. —

2166 cop Plover. male : middle claw serrated.

2167 cop Lanius : female. —

2168 cop Snipe : female

2169 : cop 2170 cop Callandra (: 69 female : 70 male) (V.1216)

2171 cop Caprimulgus, male : utters at night a simple gentle, plaintive cry, which is regarded with much superstitious dread by the natives ; frequents the hills.

2172 Myothera : female : (& 2296 & 2824 Coquimbo) Called by the Chilenos el " Turco ". It is not uncommon. — Lives on the ground, sheltered amongst the bushes & thickets, which are scattered over the dry &

sterile hills. With its tail erect, & stilt-like legs, every now & then it may be seen popping from one bush to another, with uncommon celerity. It really requires little imagination to believe the bird is ashamed of itself & is aware of its most ridiculous figure. — An ornithologist, on first seeing it, would exclaim, " a vilely stuffed specimen has escaped from a museum & has come to life again "! — Does not *run*, but hops. It cannot be made to fly, without much trouble. The various, loud cry's, which, when concealed amongst the bushes it utters, are as strange as its appearance. — Is said to build its nest, in a deep hole underground. — Gizzard very muscular ; contained beetles, vegetable fibres & pebbles. — When I first examined this bird, I thought, from the length & strength of its legs, soft membranaceous covering to nostrils & muscular gizzard, it was a distant relation to the order of Gallinaceous birds. | [*Note* (*a*) *on verso of page* 63] Specimen (1039) in spirits for dissection |

Valparaiso
MS. 64
2173 } cop
2174 }

Myothera female : (& 2174). This bird is called by the inhabitants " Tapacolo ", or " cover your posterior ". The name is well applied, as it generally carries its short tail, more than erect, that is inclined backwards & towards the head. — It is very common ; frequents the bottom of hedges & thickets, also the bushes scattered over the sterile mountains, where scarcely another bird exists. Hence this bird forms a conspicuous figure in the ornithology of Chile. In its general manners of feeding, of quickly hopping out & back again to the thickets, of preferring concealment, in its unwillingness to take flight, & in its nidification there is a close resemblance to the Turco. Its appearance however, is not quite so ridiculous as in that bird, & it may [be] said that in consequence, it [show *del.*] exposes itself with greater readiness. The Tapacolo is very crafty, it will remain motionless at the bottom of a bush, & will then, after a little time, try, with much address to crawl away on the opposite side. It is moreover an active bird & generally making a noise ; these noises are various & strangely odd, some, are like cooing of doves, others like bubbling water, & many defy all similes. The country people, say it changes its cry, five times in the year ; so that I suppose, they vary them according to the Season. [*Note* (*a*), *verso of MS.* 64.] Specimen in Spirits (1037) & (1052)] As far as I am aware, the Tapacolo & Turco are only found in central Chile ; in their hopping powers they are well adapted to a country dotted over with bushes & thickets.

MS. 65
Myothera cop
(2825).
Valparaiso
August & Sept :

This species I first met with | at Illapel, about half way between Valparaiso & Coquimbo. — I do not believe it occurs further Southward, but in the desert country as far as Copiapò it is not uncommon. — In its habits, in almost every respect, it resembles the Tapacolo, whose place, in these more arid parts, it may be supposed to supply. — When

hopping its tail is not carried in quite so erect a position, as in that bird. —

With respect to the geographical distribution of this genus; in the damp & gloomy forests to the Southward, we have three species (2127 : 2531 : 3436). — in the intermediate country the Tapacolo & Turco, and a little more to the Northward, where the land is nearly a desert this sixth species. — It is a singular circumstance, that Molina, when describing the remarkable birds of Chile, says not a word about this genus. — Was he at a loss to classify it ?. — [1]

2175, 2176, female } Finch : male : called by Molina " Phytotoma rara ". Although to this day called " rara ", — or rare ; the farmers complain that, such is far from the case. — It is a very destructive bird to the buds of fruit trees ; is quiet & solitary, haunts hedge rows & thick bushes, in the manner of our bullfinch. — iris bright scarlet. — Specimen in Spirits (1043). —

2177 : 2178. Fringilla V. 2132

2179 : 2180. Trochilus (latter male) V. Page 60

2181 cop 2182 cop Larks. both males

2183 cop Water Hen : male :

2184 Bittern : female

2185 Woodpecker : female : called by Molina " Carpintero "

2186 Icterus ; frequents marshy grounds. builds in reeds | is found [abundantly *added*] all over Chili, as far as the valley of Copiapò. — Is common also in la Plata. Molina says it is called Thili or Chili, & from this derives the name of the country. —

Valparaiso Aug : Sept: [***1834***] MS. 66

2187. do. female.

2188 cop. Arenaria : male :

2189 Fringilla — male. —

2190 cop Red throated creeper : male.

2191 cop creeper female

2192 cop do male

2193 cop Long-tailed tit : V. 1469

2194 cop Wren : female : Builds in holes in walls ; in October

2195 Fringilla : male : " Siu " of Molina, often kept in cages.

2196 Emberiza. Male.

2197. cop Muscicapa : female : in small flocks amongst the hills. In the valleys of the Cordillera, at a height of between 8 & 10,000 ft, where the last remains of vegetation are found, this bird exists, where no other can. —

[1] The discussion of this genus shows how Darwin was using his critical discernment of specific differences in the different geographical regions; the species were sharply defined in the changing habitats of the vast continent. Darwin expands his criticism of Molina in both *Beagle* '39 and '45 in almost the same words in a footnote which ends : " Was he at a loss how to classify them ? and did he think that silence was the more prudent course ? It is one more instance of the frequency of omission by authors, on those very subjects where it would be least expected."

It will be noted that Darwin alludes to the genus as *Myothera* in the O.N.s, but in both *Beagle* '39 and '45 the genus has become *Pteroptochus*, Rittlitz. He had therefore written the O.N.s before he had this new ruling.

Even in the Cordillera of Copiapò it was present ! Hops & flies about (like a Stonechat) the streams & marshy spots ; expands tail, especially on alighting on stone or ground, like a fan. — Is this the same species as (2128), which was always seen on the beach of Chiloe : if so an open place must be its attraction. —

2198 cop Muscicapa : female : V. 1819

2199 cop Muscicapa : female

2200 cop Swallow. male

2201 cop do. — do — other species

2208 cop Muscicapa. (same as 903). Has a large geographical range, being found from la Plata, round by Tierra del Fuego to Northern Chili at Copiapò.

Valparaiso Aug: Sept: [***1834***] MS. 67 It is everywhere common, — is a most quiet, | tame inoffensive little bird. Feeds on the ground ; frequents sand dunes, sandy beaches & rocky coasts. — May be said never willingly to leave the close neighbourhead of the sea ; but, as happens with Furnarius (1823) the broad stony beds of the torrents in Chile, have tempted it inland. Is said to build in low bushes.

2220 cop Dove. female

2296 cop Myothera. V. 2172

2297 cop Furnarius. V. 1222

2298 cop Tufted tit ; is tolerably common : is found also in Patagonia & T. del Fuego : Habits like a Parus, hopping about bushes. I found in August its nest, which was placed in a bush, was small soft & simple. —

2299 Fringilla V. 1615

2300 Fringilla : female. —

2319 Nest of *large* Humming bird (2179)

2320 Nest of (2132). Fringilla dinca

2321 Penguin. coast near Valparaiso. —

N B Besides the Birds enumerated, I saw the following. Icterus 1784 very common : Sturnus ruber. do : Turdus 2125. common : Vanellus 1602 : Furnarius 1823 : Furnarius 1467. rare : Scolopax-Perdrix : Certhia 2084 : Certhia 2129 : Vultur aura : Condor : Caracara. 2 species : Lanius 2124 common : Alcedo 2122 : Fringilla 2016. rare : Fringilla 2017 not uncommon. — These birds were all shot within a few miles of Valparaiso. —

I may here also add a list of the few birds I saw in crossing the Andes to Mendoza, at a height which could not have been less than 8000 ft : at the upper limit of vegetation : Condor : Fringilla 1615 : Fringilla 2015 : Furnarius 1823 : Muscicapa 2197 : and at about 10,000 ft. a Trochilus, species unknown. |

MS. 68

2375 Egg of Lanius (2124)

2425 Nest & eggs of Trochilus (2134)

2426 Egg of Furnarius (1823)

2427 Egg of Partridge (2159) Valparaiso

2434 cop Godwit in large flocks. East coast of Chiloe

2435 cop Grebe do — do —

2436 Myothera. — not common. — called by the Chilotans Cheuqui ; — there is a very close resemblance in habits, & even in plumage, to the Cheucau (2127). A resemblance — which the nearly similar name would appear to indicate. Forest. East coast of Chiloe

2479 } Woodpecker. Male & female, shot up on a mountain, in the Peninsular
2480 } of Tres Montes.

2481 Dove Hab : — do — do

2501 Curlew : male : this bird is very abundant on all the mud-banks, which surround parts of Chiloe : as the flock rises, a shrill note is uttered by each bird — interesting species allied to N. Hudsonius [*Note added in margin.*] N. = Numenius

2502 cop Wren : male : Inhabits the impervious mass of decaying vegetable matter in the interior parts of the forest amongst the Islands of the Chonos Archipelago. It hops about in a skulking manner, & every now & then utters its strange & loud notes. — This bird frequents the same kind of places with the Myothera. Does not the size of its coarse legs & beak point out some distant alliance ? This wren is (if I remember) the same as that of Port Famine ; I am told also it has been, but most rarely seen in central Chili

2503 Trochilus : male ? V 2134. —

2531 cop MS. 69 Myothera : male : commonly called by the English the Barking bird, & by the Chilotan Indians " Guid-guid " — It is abundant in the forests of the West coast, from Concepcion, to | some way South of the Peninsular of Tres Montes. In Chiloe, where this specimen was shot, they are very common ; at intervals in almost every part, a noise *precisely* like the whelping bark of a puppy may be heard. From this resemblance arises its English name. — When walking in a pathway or along the beach, suddenly the barking will be heard close by ; in vain may a person intently watch the thicket, whence, every now & then the noise proceeds ; in vain may he try, by beating the bushes, to see its author ; at other times by standing still, especially within the forest, the bird will hop close by. It is rather shyer than the Cheucau, but in its manners & general appearance very closely resembles that Bird. Like the Turco of Chili it is with difficulty made to take flight. — Is said to build its nest amongst sticks close to the ground ; — The nature of the country offers good reason, why this bird & the Cheucau, build in such a different manner from the Tapacolo & Turco ; in these forest[s], it would be impossible to make a deep hole, in other than extremely humid soil. [*Note B added, between the two* (*a*)*s on verso* Specimen of Barking bird in Spirits (1157)] In my rough notes on the Chonos Islds, I describe the strange noises, which may commonly be heard within, yet without destroying the silence of those gloomy forests. The whelping of the Barking bird, & the sudden whew-whew of the Cheucau, sometimes

come from afar & sometimes from close by ; the little black wren adds its cry. The Certhia follows the intruder, screaming & twittering. The
MS. 69 *verso* Humming bird, darts from side to side emitting like | an insect its shrill chirp. And lastly from the top of some high tree, the indistinct, but plaintive note of the white-tufted Muscicapa. (1819) may perhaps be noticed.[1]

MS. 69(a) *verso* [*added later*] These forms appear to our eyes singular to be the common birds. throughout an extensive country. In T. del Fuego the Certhia & Troglodytes were the two most abundant kinds. — In central Chile both are found, but extremely in few numbers. — In that country (& in a like manner in a like case in other countries) one is apt to feel surprise that a species should have been created, which appears doomed to play so very insignificant a part in the great scheme of nature. One forgets, that these same beings may be the most common in some other region, or might have been so in some anterior period, when circumstances were different. — Remove the Southern extremity of America, & who would have supposed, that Certhia, Troglodytes, Myothera, Furnarius had been the common birds over a great country. — [2] |

MS. 70

2555 : cop 2556 : cop. Myothera ; latter number is a male : stomach almost full of large seeds & remnants of a few insects. — Valdivia ; thick forests ; January.

2821 cop Coot. Concepcion.

2822 cop Hawk : male : Hab. do

2823 Partridge ; shot in the lofty Cordillera of Coquimbo, only a little below

[1] With the help of Dr. Robert Stauffer and Dr. Sydney Smith, these " rough notes " have been identified with the contents of Vols. 30 i and ii, and Vols. 31 i and ii, *C.U.L. Handlist.* (See p. 204 above, draft II of Darwin's ornithological writing.) Much work remains to be done on these volumes, which contain the consecutive accounts of all Darwin's specimens in every realm, written on board *H.M.S. Beagle* shortly after the time of their collection. Here we can see the gaps in the numerical record in the O.N.s filled by other types of specimens. The ornithological portions are what Darwin had in front of him when compiling the O.N.s, and indeed he often copied passages almost verbatim. If it is now agreed that the O.N.s were written during the last months of the voyage, apart from the additions clearly made when within reach of expert opinion in England, then changes of Darwin's point of view or traces of early pointers towards evolution, may still be found in these volumes 30 and 31, which ante-date the O.N.s.

[2] This passage on species range and note on reverse of MS. 70, p. 260, show how much and for how long a time this question of distribution was exercising Darwin's mind. He noticed both how common species continued over extensive areas, and how widely divergent genera were sparcely represented far from those regions where they are or were common. (*Synallaxis* and *Scytalopus.*) In *B.* '39, p. 353, this discussion is somewhat enlarged, and he still remarks " One wonders why a distinct species should have been created." We can see this in the light of later knowledge as a very transparent curtain to evolutionary views far advanced. But I believe that already by 1834–35 there were questions being asked in the O.N.s that could only have been based on a groping belief in some form of descent with modification. I have looked up the equivalent passage in the early draft in Vol. 31 i, *C.U.L. Handlist* p. 277, reverse, Wilmot paper, 1828. Darwin writes from Valparaiso, dated Aug.–Sep. 1834 : " It appears to me surprising how many of the birds of T. del Fuego & Patagonia are common in Chili " On p. 278 he writes : " The ornithology of the valleys on the Eastern slopes differ to a certain extent from the Pacifick sides." Here is a dated expression of surprise, and a dated search for species ranges and differentiation which should dispel for ever talk of random observations ; Darwin was already seeking for an explanation of the origin of species.

the line of perpetual snow. — At a similar height, in the nearly *absolutely desert* mountains of Copiapò, I saw a covey of five rise together. On the wing the[y] [made *del.*] uttered much noise & flew like grouse : were wild : are said never to descent to the lower Cordillera — Coquimbo

2824 cop Myothera. Turco. V. 2172 Hab. do
2825 cop do. (diff. species) V. P.64 or No.2174. — do
2826 cop Furnarius. V. 1823 do
2827 cop do V. 1467 do
2828 cop Grey bird : male : very common in the worst Traversias, or deserts : do
2829 Fringilla Coquimbo

N.B. Before leaving the coast of Chili, I will give a list of all the birds I saw in the neighbourhead of the valley of Copiapò, in Lat. 27°. 20 S. As, a short way to the Northward of this, the desert of Atacama commences, where nothing can exist, this valley makes an important boundary in the country & no doubt limits the distribution of many birds. — Fringilla : 1615 : 2177 : Thenca 2169 : & white tailed bird closely allied to do : 2193 : Wren 2194 : 2197 : Dove : 2163 : Lanius 2124 : Icterus 2186 : Scolopax-Perdrix : Fringilla 2017 : 2825 : 2172 : 2125 : 2297 : 1823 : Swallow. 2200 : Hawk. 2014 : Caracara 2029 : & vulgaris : Condor : Partridge 2823 : the common kind, although so abundant in the next valley to the S. of Guasco is never seen here. |
[*These two lines deleted with two oblique lines.*]

MS. 70(a) *verso* It appears to me, that when the lists & collections of birds made in the different parts of S. Southern America, are compared, a large number will be found to have surprisingly large geographical ranges. No doubt the similarity in physical constitution of the country ; over T. del Fuego & the whole west coast as far north as Concepcion ; & again, between Patagonia, the lofty valleys of the Cordillera, & northern Chili ; & lastly but in a much lesser degree ; between la Plata & central Chili, is the chief cause of this fact. — I should observe, that in the few cases, where I have spoken of Lima, (Lat 12°) as the Northern Habitat of any species ; it is probable, that the real boundary lies ten degrees further north, (near C. Blanco) where the arid open country of Peru is converted into the magnificent forest land of Guyaquil.[1] — |

MS. 71

3189 cop Petrel. Callao Bay, — Lima
3190 cop Petrel. Iquiqui. Peru
3191 cop Plover. near sea beach. do.
3204 cop Tyrannus. — Lima. —

[*The writing of the five Galapagos pages is almost uncorrected and well written, suggesting a new pen and time for reflection.*]
The Archipel : of *the Galapagos* : *end of Sept* & part of Oct : 1835

[1] This note added on reverse of MS. 70, is clearly written *before* Darwin had had time for a full comparison of his lists and collections of birds. In Vol. 29 i, *C.U.L. Handlist*, p. 41 (Fincher 1836 Watermark) occur Tables of ranges of birds crossing or not crossing the Andes, showing the direction of his thought soon after his return home.

1835 These islands are scattered over a space of ocean, included between 125 miles of Latitude & 140 of Longitude. They are situated directly beneath the Equator and about 500 miles from the coast of S. America. The constitution of the land is entirely Volcanic ; and the climate being extremely arid, the islands are but thinly clothed with nearly leafless, stunted brushwood or trees. On the windward side however, & at an elevation between one & two thousand feet, the clouds fertilize the soil ; & it then produces a green & tolerably luxuriant vegetation. In such favourable spots, & under so genial a climate, I expected to have found swarms of various insects ; to my surprise, these were scarce to a degree which I never remember to have observed in any other such country. Probably these green Oases, bordered by arid land, & placed in the midst of the sea, are effectually excluded from receiving any migratory colonists. However this may arise, the scarcity of prey causes a like scarcity of insectivorous birds & the green woods are scarcely tenanted by a single animal. The greater number of birds haunt, and are adapted for, the dry & wretched looking thickets of the coast land : here however a store of food is laid up. Annually, heavy torrents of rain at one par-

Galapagos MS. 72 ticular season fall ; grasses and other plants | rapidly shoot up, — flower, & as rapidly disappear. The seeds however lie dormant, till the next year, buried in the cindery soil. Hence these Finches are in number of species & individuals far preponderant over any other family of birds.[1] Amongst the species of this family there reigns (to me) an inexplicable confusion. Of each kind, some are jet black, & from this, by intermediate shades, to brown ; the proportional number, in all the black kinds is *exceedingly* small ; yet my series of specimens would go to show, that, that color is proper to the old cock birds alone. — On the other hand — Mr. Bynoe & Fuller assert, they have each a small jet black bird of the female sex. —[2] Moreover a gradation in form of the bill, appears to me to exist. — There is no possibility of distinguishing the species by their habits, as they are all similar, & they feed together (also with doves) in large irregular flocks. — I should observe, that with respect to the probable age of the smaller birds, that in no case were any of the feathers imperfect, or bill soft, so as [to] indicate immaturity, & on the other hand — in no case — were the eggs in the ovarium of the hen birds much developed. — I should suppose the season of incubation would be two or *three months* later. —

[1] The interest in the capture of the specimens during the voyage was evidently shared by other members of the expedition. Discussions must have taken place—or perhaps Darwin sometimes maintained silence to preserve the peace. Captain FitzRoy's account of the birds of the Galapagos is worth quoting in this respect.

" All the birds that live on these lava-covered islands have short beaks, very thick at the base, like that of a bullfinch. This appears to be one of those admirable provisions of Infinite Wisdom by which each created thing is adapted to the place for which it is intended. In picking up insects, or seeds which lie on hard iron-like lava, the superiority of such beaks over delicate ones, cannot, I think, be doubted . . . " *Voyage of the Beagle*, Vol. II : 503, 1839.

[2] Opposite this passage in margin is written " analogous [or analogues] to Mr. Blyth's case."

3296 Heron : female. — sea coast & salt lagoons. —

3297 cop 3298 [*Encircled in MS*] Caracara. (former male, latter young female) V. P. 42

3299 cop Duck : male : salt water lagoons : bill lead coloured. base of upper mandible purple with black marks above.

3300 Bittern. Female

3301 do — do

3302 cop Tern. — F

3303 cop Owl. — Male. Fuller has another species |

Galapagos MS 73

3304 cop Gull : male

3305 cop Dove : do : One of the most numerous birds in the Islands.

3306 cop } Thenca : male : Charles Isd —

3307 cop } do : do : Chatham Isd. —

These birds are closely allied in appearance to the Thenca of Chile (2169) or Callandra of la Plata (1216). In their habits I cannot point out a single difference ; — They are lively inquisitive, active *run fast*, frequent houses to pick the meat of the Tortoise, which is hung up, — sing tolerably well ; are said to build a simple open nest. — are *very* tame, a character in common with the other birds : I *imagined* however its note or cry was rather different from the Thenca of Chile ? — Are very abundant, over the whole Island ; are chiefly tempted up into the high & damp parts, by the houses & cleared ground.

I have specimens from four of the larger Islands ; the two above enumerated, and (3349 : female. Albermarle Isd.) & (3350 : male : James Isd). — The specimens from Chatham & Albermarle Isd appear to be the same ; but the other two are different. In each Isld. each kind is *exclusively* found : habits of all are indistinguishable. When I recollect, the fact that the form of the body, shape of scales & general size, the Spaniards can at once pronounce, from which Island any Tortoise may have been brought. When I see these Islands in sight of each other, & [but *del.*] possessed of but a scanty stock of animals, tenanted by these birds, but slightly differing in structure & filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware, is the constant | asserted difference — between the wolf-like Fox of East & West Falkland Islds. — If there is the slightest foundation for these remarks the zoology of Archipelagoes — will be well worth examining ; for such facts [would *inserted*] undermine the stability of Species.[1]

Galapagos MS. 74 [***1835*** Sep–Oct]

3308 cop Yellow breasted Tyrannus : Female : Chatham Isld :

3309 cop Scarlet do. Male

3310 Wren Male

[1] Sir Gavin de Beer has pointed out to me that in Evolutionary Notebook I, begun in July, 1837, there is a further clue which helps to date the Galapagos passage. Page 7

3312	Fringilla		Male	
3313	do.		(Sex unknown)	
3314	do.		Female	V. suprà
3315	do.	—	do	
3316	do.	—	Male	
3317	do.		Male	
3318	do.	—	Male	
3319		—	Male	

3320, 3321[2], 3322, 3323 (Icterus 3320 : Male. jet black).(3321 : 3322 Males) (3323 Female). This is the only bird, out of the number which compose the large irregular flocks, which can be distinguished from its habits. — Its most frequent resort is hopping & *climbing* about the great Cacti, to feed with its sharp beak, on the fruit & flowers. — Commonly however it alights on the ground & with the Fringilla in the same manner, seeks for seeds. The rarity of the jet black specimens is well exemplified in this case ; out of the many brown ones which I daily saw, I never could observe a single black one, besides the one preserved. Mr. Bynoe however has another Specimen ; Fuller in vain tried to procure one. — I should add that Specimen (3320) was shot when picking together with a brown one, the fruit of a Cactus.

3324 Fringilla. Male. (Young ?)

3325 do — Female. — |

Galapagos—

MS. 75

3326 Fringilla : Female : there were very many individuals of exactly the same plumage. —

3327 Fringilla — Male

3328 do — Female

3329 do — do

3330 . . . Male :) (3331 Female) (3332 Male). — This species is well charac-

of Note-book I, (*Bulletin of the B.M. Historical Series*, **2** : No. 2, 1960), consists of the following remarks :

" Let a pair be introduced and increase slowly, from many enemies, so as often to intermarry, who will dare say what the result.

" According to this view, animals on separate islands, ought to become different if kept long enough apart, with slightly differ[ent] circumstances. — Now Galapagos tortoises, mocking birds, Falkland fox, Chiloe fox. — English and Irish Hare. — "

The Galapagos passage in the O.N.s must have been written before Darwin knew of the Irish and English Hare, for the " only facts of a similar kind " of which he was aware when he wrote this much quoted passage, were the differences between the East and West Falkland Foxes.

There is also a passage in the last of the small pocketbooks Darwin carried with him for immediate notes on the voyage, in which at any rate some of the entries date from the last lap home, though others may be of later date. There are notes on the islands of Ascension and St. Helena, and quotations from conversations with Sir A. Smith and Sir J. Herschel, both of whom he met at the Cape of Good Hope. In this pocket-book he writes :—" Ascension, vegetation ? Rats and Mice : at St. Helena there is a native Mouse."

Here the idea originating in the Galapagos is being applied to islands visited later in the homeward journey.

[2] Encircled number ; unexplained.

3331 terized by its curious beak. — Is a true Fringilla in its habits. — I only
3332 saw this bird in one Island. — James Isld — & in one part alone of it. — Was feeding in considerable numbers with the other species. Mr. Bynoe has a much blacker variety. — [Capt. FitzRoy's specimen comes from same isld — *written in margin*.]

3333 Fringilla. — Male
3334 do — do
3335 do — do
3336 do — do
} N B. The Gross-beaks are very injurious to the cultivated land ; they stock up seeds & plants, buried six inches beneath the surface. —

3337 do — Female. — Upper Mandible is in Pill Box. (3361)
3338 do — do
3339 do — do
3340 Male
3341. Fringilla. Male. — I saw specimens with *precisely* similar plumage, which were females

3342 cop Tyrannus. Male. (Young of 3309 ?)
3343 cop — do —
3344 cop — Female
} N.B. This genus Tyrannus frequents the upper damp woods as well as arid country.

3345 cop Tyrannus : Male : I believe this species is certainly distinct from the scarlet breasted one ; (& its yellow breasted female ?) (3309)
3346 cop Sylvia. Male. Frequently near the coast. —
3347 cop do. — do.
3348 cop do Female
3349 cop Thenca. Female. Albermarle Isd
3350 cop do — Male — James Isd
} V. 3306. —

3351. Water Hen : Female
3352 cop do. Female
3353 do. Male
} This is I believe, the only bird which is exclusively found in the high & damp

Galapagos parts of Charles & Jame's Isld. — It frequents *in numbers* the damp beds of Carex & other plants ; uttering loud & peculiar crys. — There is no water in these parts, but the soil is humid. — Is said to lay from 8 to 12 eggs. — iris bright scarlet : is called Gallinita del monte. —

3354 cop Charadrius. Female (rather less British specimen Gould. but accords in all its markings)
3355 cop Tringa — Male
3356 cop Swallow: Male: This bird was seen in small numbers near some bold rocky precipices on the coast, in one part of James Isd. & no where else. —
3357 cop Charadrius. Female. — AEgialitis semipalmata
3358 : cop 3359 [*Inserted* Pelidna minutilla] Fringa. both Females. — Same as N. American Species.

3362 Contents of the stomach of a Flamingo : these sphaerico-concretionary globules appeared to me to be worth examining ; they were involved in mucous matter, besides which the Stomach contained nothing. — The Bird was shot in a shallow, saltwater Lagoon. — Throughout this archipelago there is very little Calcareous matter. —

3374 cop — Anthus. was shot by Fuller on James Isd : it was the only one specimen seen during our whole residence. It is described as rising from the ground suddenly & again settling on the ground. — Showed in its flight long wings, like a Lark ; uttered a peculiar cry. — Its structure appear[s] very interesting.

V. Infra — Specimen for dissection (1309) in Spirits. —

3375 cop (a) — Sterna shot in the ocean at night, some hundred miles from land in the Pacifick. (a) [MS. 76 *verso* :] Terns have been supposed not to go far to sea : Seventy miles off the R. Negro coast of Patagonia I saw some : and 120 miles from the nearest land off Bahia Brazil, there was a flock of the snow white kind fishing, late in the evening.

3413 — Bird, common. New Zealand

3591 cop — Land Rail ; very *common* on dry low coral small Islands of Cocos ; excepting Snipe, only bird without web-feet. —

Galapagos MS. 77 — To conclude with the Ornithology of the Galapagos, I have reason to believe, the joint collection of Mr | B[y]noe Fuller & myself include all the land birds. There are no Hawks besides the Caracara : there are no Humming birds. — On the coast only one species of Gull, Tern, Duck : Heron, and two Bitterns all of which I have. — The Flamingo : Mother Cary's chicken : Procellaria 3190, & other species : [Frigate Bird *in margin*] Common Pelican & Gannet of coast of Peru, & other Gannet, black & white found in the Pacifick : Amongst the small Waders Mr Bynoe & Fuller possess species which I have not. I believe this the only imperfect (by 3 or 4 species) part of our Catalogue. —

Whether the Flora of these Islands is S. American ; or differs from it, in a like manner as Juan Fernandez does, which is much less further removed, I do not know : but the Ornithology to my eyes resembles that of the temperate parts of that Continent. —

Tameness of Birds — There is one fact which is extremely singular in the Natural History of these Islds ; it is the tameness of all the land birds. It is common to the Thenca, to all the Finches, to the Sylvia, the Tyranni, the Doves & the Caracaras.[1] In Charles Isd., which had been inhabited some 6 years [*Altered from* has now been inhabited 6 years] a boy with a long stick, sits down by a well & kills as many doves & Finches as he wishes. — There is not a bird which cannot be killed by a switch & sometimes by a Hat or Cap. — I have pushed, with the muzzle of my gun, a Caracara off the branch, on which it [*corrected from* he] was sitting. The Thenca has drank water, out of the back or shell of a Tortoise, held in my hand, & has so been lifted from the ground ; I have even tried to catch them by the legs, but failed. In attempting to explain this, we must remark |

[1] Obliquely in margin is written : " Will the Furnarius ever learn not to bore the walls." Also : " Rooks with guns ". An early indication of thought on the problem of the inheritance of instincts.

MS. 78 that no rapacious hawks or quadrupeds are found here ; the only large animal is the harmless Tortoise. Do the birds mistake Man, for this huge Reptile ?[1] It must however be remembered[2] that these Islds for the last hundred years, have been frequently visited by Whaling & other vessels ; & the Sailors wandering through the woods in search of Tortoises, always take delight in knocking down the small birds.[3] Excepting the often described stupidity of some pelagic birds ; in only one other place, have we seen, during our voyage, an exemplification of a similar fact & that was in E. Falkland Isd. — The extraordinary tameness of the black Furnarius, has been remarked on since the time of Pernetty to the present day.[4] M. Lesson [likewise *added*] mentions it. But it is not peculiar to that bird. It is seen in the Caracara, Snipe & Goose. When lying down, on the rocky hills the Thrush & [Emberiza *del, possibly* ' birds ' *added*] hop all around & close to you. Even the true Hawks are not very wild.[5] It is the more remarkable in this Isd. as it is tenanted by true Hawks & Foxes, & has long been visited by Man.[6] This tameness & especially amongst the Water-fowl is strongly contrasted with the habits of the same birds in T. del Fuego. In that country, for ages past, they have been disturbed by the savage inhabitants.[7] Does the disposition or instinct of a bird gradually alter from any cause acting on *successive* generations ? I must confess, that on the desert banks of the S. Cruz (which probably had never been ascended [before us *del.*] by other Europaean before us) the Goose & Duck which at the Falklands are so tame, there were as wild as similar

MS. 79(a) *verso* birds in England. They might however | have been migratory from T. del. Fuego. — The subject does not seem to me of very easy

MS. 79 explanation. — |

Frigate Bird. [*The Frigate bird passages have been much corrected and two sections deleted. Two additions were made on separate page, one*

[1] " Like sparrow does cow " very faintly in margin.

[2] Faint suggested alterations are written over these words : " This is perhaps " and " This is more surprising ". In *Beagle* '39, p. 476 the sentence runs : " It is surprising that the change has not been greater." In *B.* '45, p. 399, " It is surprising that they have not become wilder."

[3] Faint marginal addition : " Formerly birds tamer ".

[4] Note (B) on p. 78a : " ♀ Was not the Furnarius tamer at the time of Pernetty, than at present ? V. Account. — See A. J. Pernety, *Journal historique d'un voyage fait aux Iles Malouines*, 1763–4. Berlin, 1769.

[5] A further faint insertion in margin occurs at this point a probable reminder for the final writing of the script for the printer. " In time of Pernety Malouines like Galapagos." Malouines was the old name for the Falkland Islands until ceded to Britain in 1771.

[6] Between the lines in this sentence are two almost illegible fragments : " turtles in land " and " increase probably owing to settlers ".

[7] Obliquely in margin is added : " Black necked Swan ". In *Beagle* '39, p. 477, Pernety's *Voyage aux Iles Malouines*, Vol. II, p. 20 is referred to in a footnote, and quoted in the text. Pernety relates that it was impossible to kill the black-necked swan ; Darwin comments : " It is rather an interesting fact, that this is a bird of passage, and therefore brings with it the wisdom learnt in foreign countries." In *Beagle* '45 the wording is slightly different, no footnote is given to Pernety, whilst further facts are recorded bearing on the tameness of birds and the wildness as regards man.

afterwards deleted. I give below firstly the original draft, including all deletions but indicating where the larger ones occur, and without corrections. Secondly I give the final form, with corrections and additions, and without the deleted sections.]

[*Original draft.*] Amongst the Galapagos Island[s], during several occassions, I was interested by watching, the habits of this bird, which partly explained to me, the cause of its peculiar figure. [del.] The Frigate bird, when it sees any object floating on the surface of the water, descends, with depending head, from a great height, like an arrow ; and at the instant of seizing with its long beak the prey, it turns upwards, by the aid of its tail & long wings, with the most extraordinary dexterity. The bird never touches the water with its wings, or even with its feet ; indeed I have not seen one, ever swimming on the water. [*Point of insertion of note* (3) *on separate page, and beginning of second deletion.*]

It is a noble bird seen on the wing, either when soaring in flocks at a stupendous height, or as showing their most perfect skill in evolutions, when many are darting at the same floating morcel. If the piece of meat sink above six inches beneath the surface, it is lost to the Frigate Bird [*Point of insertion of deleted addition* (*b*) *on separate page, and end of second deletion.*] (b) at Ascension this bird is said to destroy great numbers of the young [tortoise *del.*] turtle, as they come out of the eggs & run down to the sea. They take them off the sand in the same manner, as I have described from the surface of the water. One bird will swallow a considerable [number] one after another without waiting.

[*Final form of Frigate Bird passages, with corrections and additions, omitting three deleted sections. There is a large encircled A in the margin opposite the beginning, and a large square bracket.*]

The Frigate bird when it sees any object on the surface of the water, descends in an inclined plane from a great height head foremost with the swiftness of an arrow ; and at the instant of seizing with its long beak & outstretched neck the floating morcel, it turns upwards, by the aid of its forked tail & long powerful wings, with extraordinary dexterity. The bird never touches the water with its wings, or even with its feet ; indeed, I have never seen one swimming on the sea ; one is led to believe that the deeply indented web between its toes is of no more use to it than are mammae [or the marsupial bones *inserted*] in the male sex of certain animals ; or the shrivelled wings beneath the wing-cases firmly soldered together of some coleopterous beetles. — The Frigate is a noble bird, when seen, either soaring in a flock at a stupendous height (at which times it merits the name of the Condor of the ocean)[1].

[1] There is no discussion of the Frigate Bird in either *Beagle* '39 or '45, though it is figured and discussed in *Zool. of Beagle* '41, where the analogies of the vestigial mammae and the marsupial bones with the partial webbing of feet are omitted. I can find no reason why the Frigate bird, over which Darwin had thought so much, should be left out of the *Journal of Researches*. He uses the argument in an evolutionary passage in *The Origin*, 1st edition, p. 185, 1872 edition, pp. 142–143, where he writes : " What can be

Pintado. Petrel. Is excessively abundant over whole Southern ocean : Do not generally extend further Northward than two or three degrees North
cop of the Tropic : but on the coast of Peru saw them between 16°–17° S. [*Obliquely added in margin* : — Cook New Zealand.] These bird[s] differ rather in their habits from the greater number of their Congeners : agree most with Petrel (1335). Are Social, constantly following a Ship in numbers. — are very tame, — pass a good deal of their time swimming, seem thus to take their food. Often dive to the depth of a foot or two ; When quarrelling over any offal — utter a variety of harsh crys, not loud. — Flight rather slower, & more soaring than in many of the
MS. 79(a) tribe, very elegant ; (a) as it alights on surface of water, expands tail
verso like a fan. Although flying all day on a moonlight night they may be still seen on the wing. — I was told by a Sealer that they, together with (1335) & Mother Cary's Chicken, all build in the cliffs of South Georgia ; And that no other breeding place is known of. — They all arrive very regularly in September & leave again in the Autumn. — That the Albatross alone stay the Winter. —

The *small Blue Petrel* is found from Lat. 33° to 35° (agrees with Capt Cook's statements)
cop over whole Southern Ocean. — Is wild, flight very rapid, solitary, or not many together. [See Lesson, *written in margin.*] Mr. Stokes informs me that, these birds build in holes on the Landfall Isd. in T. del Fuego. — These burrows are about a yard deep ; they occur over half a mile inland. On stamping on the ground, many will fly out of one hole —. Eggs white elongated, size of a Pidgeon. — |

MS. 80

Struthio Rhea. [*The name is lightly erased, and the paragraph is preceded by an unclosed square bracket, possibly connected with end of paragraph mark, MS.* 83(*b*). Beagle, '39 *closely follows the Ostrich passages, pp.* 105–110. Beagle, '45 *is considerably condensed and altered, pp.* 89–94.]

This bird is well known to abound over the plains of Northern Patagonia & the united Provinces of la Plata. It has not crossed the Cordillera to the Westward ; but I have seen it within the first range of mountains on the Uspallata plains [elevated *added*] between 6 & 7000 ft. — The ordinary habits of the Ostrich are familiar to everyone. They feed on vegetable matter ; such as roots & grass. [*Altered from* : ' & in their stomachs I have frequently seen roots '.] At low water at Bahia Blanca, I have repeatedly [frequently *del.*] seen three or four

plainer than that the webbed feet of ducks and geese are formed for swimming ? Yet there are upland geese with webbed feet which rarely go near the water ; and no one except Audubon has seen the frigate-bird, which has all its four toes webbed, alight on the surface of the ocean. . . . The webbed feet of the upland goose may be said to have become almost rudimentary in function, though not in structure. In the frigate-bird, the deeply scooped membrane between the toes shows that structure has begun to change."

" Mammae in man & wings under united elytra " are mentioned together in Darwin's Notebooks on Transmutation of Species, Pt. IV, *Bull. B.M.* **2** : No. 5, Ed. by Sir Gavin de Beer, p. 148 MS, p. 177 print. As this Notebook was written after 3rd October, 1838, the above passage in the O.N.s must have preceded the Notebook by more than two years.

come down to the extensive Mud banks which are dry at low water. The Gauchos say it is for the sake of catching small fish. —
Although the Ostrich in its habits is so shy, wary & solitary, & although so fleet in its paces, it falls a prey, without much difficulty to the Indian or Gaucho, armed with the Bolas. When several horsemen appear in a semicircle it becomes confounded & does not know, which way to escape. — [is its best line to take *del.*] They generally prefer running against the wind ; yet at the first start they expand their wings & like a vessel, make all sail. — On a fine hot day, I have seen Ostriches enter a bed of tall rushes & there squat concealed, till quite *closely* approached on horseback. It is not generally known that ostriches readily take to the water. — Mr. King informs me that at the Bay of San Blas & at Port Valdes in Patagonia he saw these birds swimming several times from island to island. — They ran into the water both when driven down to a point, & likewise of their own accord, when not frightened. — The distance crossed was about 200 yards, when swimming, very little of
MS. 81 their bodies appears | above water, & their necks are extended a little forwards, Their progress is slow. — On two occassions, I saw some Ostriches — swimming across the S. Cruz river, where its course was
MS. 81 *verso* about 400 yards wide & its stream rapid. Capt Sturt also in Australia, when descending the Murrumbidgee, saw two Emus in the act of swimming. [*Inserted later.*]

The inhabitants who live in the country, readily distinguish, even at a distance, the Cock bird from the Hen. The former is said to be larger & darker coloured, & its head bigger. The ostrich, I believe the Cock, emits a singular deep-toned hissing note ; which cannot be described. When I first heard it, standing in the midst of some sand hillocks, I thought it came from some wild beast ; It is a sound, which, it is not easy to tell whence it comes or from how far distant. — A Gaucho assured me, that he had once seen a snow white or Albino variety & that it was a most beautiful bird. — At Bahia Blanca, in the months of September & October an extraordinary number of eggs, were found all over the country. — The egg varies in colour from a pale straw yellow to white. — The eggs either lie scattered about, which are called by the Spaniards Huachos, & are never hatched, or are collected together into a shallow excavation or nest. — Out of the four nests, which I happened to see, three contained twentytwo eggs each, & the fourth twenty-seven. — In one day's hunting on horseback sixty-four [74 *del.*] were found ; fortyfour [44 *del.*] of these were in two nests, & the remaining twenty scattered Hauchos. The Gauchos unanimously affirm, that the male bird alone hatches the eggs & for some time afterwards accompanies the young. — I conceive there is not the |
MS. 82 slightest doubt on the subject. The cock when on the nest lies very close, I have myself almost ridden over one. It is asserted that occassionally at such times, they are fierce & even dangerous, that they have been

known to attack a man on horseback, trying to kick & leap on him. — My informer pointed out to me an old man, whom he had seen much terrified by one chasing him. — [Chacing *corrected to* chasing.] I observe in Burchell's Travels in S. Africa, he remarks. " having killed a male Ostrich, & the feathers being dirty, it was said by the Hottentots to be a nest bird ". I understand in the Zoological Gardens, that the male Emu also, takes charge of the nest, & therefore this habit is common to the family. [1]

The Gauchos also unanimously affirm, that several females lay in one nest. I have been positively told, that four or five hen birds, have been seen to go, in the middle of the day, one after the other, to the same nest. I may add also that it is believed in Africa, that two females lay in one nest. (Burchell. Vol. I. P.280, —)

Although this habit at first appears very strange, I think the cause is sufficiently obvious. — The number of eggs in the nest varies from twenty to forty & even to fifty ; [*Beginning of amendment* (a) MS. 82(a) *verso*.][2] and according to Azara[3] to seventy or eighty. Now though it is probable from the number of eggs, found in one district being so extraordinarily large in proportion to that of the parent birds, and likewise from the state of the Ovarium of the hen, that she may, in the course of the season lay that number, yet the time required must be very long. — Azara states that a female in a state of domestication laid seventeen eggs, each at the interval of three days, one from another. — If the hen were obliged to hatch her own eggs, before the last was laid, the first probably would have been addled ; but if each laid a few eggs, at successive periods, in different nests, and several hens, as is stated to be the case, combined together, then the eggs in one collection, would be nearly of the same age. — [Under this view, each cock bird, or at least the greater number *del.*] If the number of eggs in one of these nests, is as I believe not greater [*altered from* the same] on an average than the numbers laid by one female in the season, then there must be as many nests as females, and each cock bird, will [in its turn *del.*] have its fair share in the labour of incubation ; and that during a period when the females could not sit, on account of not having finished laying. — [*End*
MS. 83 *of amendment* (a). *See Beagle* '39 *p.* 107, *Beagle* '45, *p.* 91–2] | I have before mentioned the great number of Huachos or scattered eggs ; so that in one day's hunting, the third part were found in this state. — It appears odd, that so many should be wasted. — Does it not arise from the difficulty of several females, associating together & persuading an old Cock to undertake the office of incubation ? It is evident, that there must at first be some degree of association between at least two females ;

[1] The last sentence, referring to the Zoological Gardens, is added later, inserted between the lines.

[2] Originally stuck on with sealing wax. See Editor's Note, p. 208. |

[3] Voyage dans l'Amerique méridionale par don Félix de Azara, 1781–1803.

else all the eggs would remain scattered over the wide plain at distances far too great, to allow of the male collecting them into one nest. [*Addition* (*b*), *MS.* 83 (*a*) & (*b*).] Some have believed that the scattered eggs were deposited for the young birds to feed upon. This can hardly be the case in America, because the Huachos although often times found addled & putrid, are generally whole. — IP[1]

Avestruz Petise [*in margin, and deleted*] [*I give below the final corrected version of the story of Avestruz Petise.*]

MS. 83 When at the R. Negro in Northern Patagonia, I repeatedly heard the Gauchos talking of a very rare bird which they called the Avestruz Petise. They described it as being less than the common Ostrich (which is there abundant) but with a very close general resemblance; they said its colour was " overo " or mottled & dark; & that its legs were shorter, & feathered lower down. It is more easily caught by the bolas than the other species. The few inhabitants who have seen both kinds

MS. 85A [*intended for* 83A] affirm they can distinguish them apart from a long distance. — The eggs [of the small species *added*] appeared however more generally known, and it was remarked with surprise that they were very little less [than those of the Rhea *added*] but of a slightly different form & with a tinge of pale blue. — Some eggs picked up on the plains of Patagonia agree pretty well with this description, and I do not doubt are those of the Petise. — This species occurs [most *added*] rarely on the plains bordering the Rio Negro, but about a degree and a half further south.[2]

MS. 84 When at Port Desire in Patagonia (Lat 48°) [*Dec. 1833*] Mr. Martens shot an ostrich; I looked at it forgetting, at the moment, in the most unaccountable manner, the whole subject of the Petise, & thought it was a two-third grown one of the common sort. — The bird was cooked & eaten. — & my memory returned. Fortunately the Head neck legs,

MS. 84A XXX one wing & many of the larger feathers had been preserved. | From the fragments a surprisingly good specimen has been put together, and it is now exhibited in the Museum of the Zoological Society. Mr. Gould, who in describing this new species, has done me the honor of calling it after my name, states that besides the smaller size & different colour of the plumage the beak is of considerably less proportional dimension

[1] The continuity of the discussion on the Ostrich given in the above text, was only reached after one major deletion, and lesser corrections. I give here the text of the long deletion, to be replaced by (a), p. 82 (a). " now although it is probable from what I have seen & heard of the state of the Ovarium of the Hen, & from the number of eggs found in one district so [very *del.*] extraordinarily large in proportion to that of the parent birds [*query owing to blot*] that she may lay that number in the season, yet the time she must require is very long. — Before the last egg was laid the first would probably be addled [decayed *del.*] — If we believe that all the [each *del.*] females lay each a few eggs in several nests; the eggs in such nests, might be collected within a short period. — We shall thus explain the extraordinary number of eggs found in any district; and moreover | *each* cock bird some time during the whole season of laying [incubation *del.*] will be employed in incubation; and at a period, when the greater number of females could not sit, owing to not having finished laying. —"

[2] This passage stuck on with sealing-wax. See Editor's note, p. 208.

than in the common Rhea ; that the tarsi are covered with differently shaped scales, and that they are feathered six inches beneath the knee.[1] In this latter respect, and in the broader feathers of the wing this bird perhaps shows more affinity to the gallinaceous family, than any other of the Struthioidae. — XXX | [End of later addition on p. 84a]

MS. 84 Amongst the Patagonian Indians in the St. of Magellan we found a half Indian who had lived some years with the tribe, but had been born in the Northern Provinces. I asked if he had ever heard of the Avestruz Petise ? He answered by saying " why there are none others in the southern countries ". — He affirmed that beyond doubt that the Avestruz & the Avestruz Petise were distinct birds (I may observe that Indians & such people are excellent practical naturalists). He informed me, that the number of eggs in the nest of the Petise, was considerably less than in the other, namely generally not more than fifteen, & he asserted that more than one female deposited these eggs. |

MS. 85 At S. Cruz we saw several of these birds they were excessively wary. I think they could see a person approaching, when he is so far off as not to distinguish the Ostrich. In ascending the river, few were seen but in our quiet & rapid descent, many in pairs & by four's & five's were observed. — It was remarked, & I think with truth, that this bird does not expand its wings, when first starting at full speed after the manner of the northern kind. The fact of these ostriches swimming across the river has been mentioned. —

In conclusion I may repeat that the Struthio rhea inhabits the country of La Plata as far as a little south of the R. Negro in Lat. 41°: & that the Petise takes its place in Southern Patagonia, the part about the R. Negro being neutral territory. Wallis saw Ostriches at Bachelors river (Lat 53°–54°) in the St. of Magellan, which must be the extreme Southern possible range of the Petise. —

[*Additional note* (*a*) 85 (*a*)i.] M. D'Orbigny when at the Rio Negro made great exertions to procure this bird, but never had the good fortune to succeed.[2] — The only notice I can find in any work of the existence of this species, is in Dobrizhoffer's account of the Abipones. (A.D. 1749) He says at Vol. I, p. 314. " You must know moreover that Emus differ in size & habits in different tracts of land : for those that inhabit the plains of Buenos Ayres and Tucuman are larger, and have

[1] Darwin had recorded most of these differences himself nearly three years earlier. See below.

[2] M. Alcide D'Orbigny, traveller and author of *Voyage dans l'Amérique méridionale, 7 Tom.* volumes, Paris 1835–47 seems to have made a prior claim to the discovery of *Rhea Darwinii*, so that Darwin's remark on his never procuring a specimen has an added interest. In the *Magazine of Natural History*, Vol. I, 1837, occurs the following note on p. 504.

" Notice respecting *Rhea Darwinii* Gould.

" We observe by a letter which lately appeared in one of the French Journals, that M. D'Orbigny claims the right of having first described the Rhea brought home by Mr. Darwin from S. America, and which Mr. Gould named, a few months since, R. Darwinii. It appears that M. D'Orbigny gave it the specific appellation of R. Pennata, but in his letter he does not refer either to his *published* characters, or to the specimen which he examined." M. D'Orbigny's claim seems to have been based on no serious foundation,

black white and grey feathers, those near to the Straits of Magellan are smaller & more beautiful, for their white feathers are tipped with black at the extremity, and their black ones in a like manner terminate in white."

An account of the Abipones by Dobrizhoffer went out to America [between the year *del.*] 1749. Vol. I. p. 314. [*Last two lines lightly deleted.*[1] *This brings the Ornithological Notes to an end*]

APPENDIX: THE AVESTRUZ PETISE, *RHEA DARWINII*

The final version of the Petise story given above, was only achieved after considered changes had been made at different dates. J. Gould's authoritative description of the new species was the last entry to be added, after the remnants of the bird had been successfully assembled and shown at the meeting of the Zoological Society in London in March 1837, when it became officially *Rhea darwinii*.

I give below extracts of earlier drafts of the same story, for those who want to examine in detail Darwin's assessment of evidence. He firstly had to collect all the evidence available as to the existence of the second species of South American ostrich, with details of its reported range; secondly he had to reach certainty as to the identity of the bird so inadvertently cooked and eaten at Port Desire.

Firstly I quote from the *C.U.L. Handlist*, Vol. 31, i, pp. 212–3, in which all Darwin's specimens are listed chronologically, with entries recorded within a few months of the events described.

The first mention of the Petise follows after lists of seaweeds, dated Jan. and Feb. 1834, thus recording within six months his first knowledge of the bird from the frequent reports of the Gauchos in August, 1833 in Northern Patagonia. Darwin briefly describes the shooting of the Petise by Martens in December 1833 at Port Desire, adding :— " which I looking slightly at it pronounced to be a young one of the common sort,—that is it appeared to be 2/3 size of the common one. I also saw some live ones of same size, but entirely forgot the Petise. I have since reclaimed the Head, Legs & several feathers [*specimen numbers*] 1832 . . . 1836." He notes the differently shaped scales on the legs, the lower feathering, and describes the eggs of a bluish tint. He quotes the Gauchos description of " overo " or speckled for the plumage. He writes of their distribution :—" With the Patagonians at Gregory Bay Straits of Magellan, 1834, there was a semi-Indian who had lived with them four years. — He tells me there are no others, excepting the Petises in these Southern parts." In the margin is written :—" Agrees with Gauchos stating there to be many in S. José.

[1] Martin Dobrizhoffer was for eighteen years a missionary in Paraguay, and as Darwin says in his deleted note, went out in 1749. His work, written in Latin, was first published in 1784, as well as a German translation from Vienna. The English translation was published by John Murray in 1822. Darwin's quotation from Dobrizhoffer ends after describing the black and white tipped feathers.

that like the other ostrich many females lay in one nest, but that mean number of eggs in one nest is considerably less, namely not more than 15. — (The Post Desire egg was a Walcho.)

Whatever Naturalists may say, I shall be convinced from such testimony. as Indians & Gauchos, that there are two species of Rhea in S. America. I bought from the Chinas some feathers & skin."

More than two years after the shooting of the Petise, Darwin added a note on the back of p. 212, *Handlist* 31, i, dated April, 1836. "The Beagle sailed from Keeling Island on April 12th, calling at Mauritius on the homeward journey." The note was marked for insertion opposite the shooting incident :

" In the plains of central Patagonia I had several opportunities of seeing this ostrich : it unquestionably is a smaller & darker coloured bird than the Rhea. It is *excessively* wary : I think they can see a person approaching, when he is so far off as not to distinguish the Ostrich ; in ascending the river tracks etc etc were very abundant yet we saw scarcely any : but when *rapidly* & quietly descending, we saw many, both pairs, & 4s & 5s together. It was observed, & justly, that this ostrich does not expand its wings, as the Northern one, always does, when first starting at full speed : takes to the water readily ; saw four crossing the river. where 400 yeards wide & very rapid ; & another day one. very little of the body appears above water."

By April, 1836, therefore Darwin was convinced that the two species were ' unquestionably ' different. The ethological characters evidently had helped Darwin in his diagnosis.

I will now turn to the early drafts of the *Ornithological Notes*, to compare them with this slowly-reached certainty :—it will be noted that they differ slightly, but significantly, from the final version given above.

First Draft of the Ornithological Notes.

" When at the R. Negro in Nothern Patagonia, Aug. 1833, I repeatedly heard the Gauchos talking of a very *rare* bird which they called Avestruz Petise. They described it as being less than the common Ostrich (which is there common) but with a very close general resemblance ; its colour was described as " overo " or mottled & darker ; that its legs were shorter & feathered lower down. Is more easily balled, than the other species, — Its egg however is more generally known, which is but very little smaller, than that of S. Rhea, but of a faint blueish-green color. — The Gauchos affirm they can distinguish the two kinds from a distance & that they are different birds. They occur very rarely on the Southern plains of the R. Negro, but that at about a degree & a half further South, they are tolerably abundant. One Gaucho said he distinctly recollected having seen one, many years before, near the mouth of the R. Colerado (to the N of R. Negro). They are said to prefer the plains near the sea."

Darwin then describes the shooting by Martens :—" I looked at it, forgetting at the moment, in the most unaccountable manner, the whole subject of the Petise, & thought it was a two-third grown one of the common sort. — The bird was cooked & eaten. — & my memory returned. Fortunately the Head & neck & legs had been preserved. The legs have different shaped scales & are feathered beneath the knees." He continues with an account of the other differences as before, and with the meeting the half-Indian in St. Gregory's Bay, Jan. 1834. " I asked if he had ever heard of the Avestruz Petise ? He answered by saying ' Why there are none others in these Southern countries.' He affirmed that beyond doubt that the Avestruz & the Avestruz Petise were distinct birds (I may observe that Indians & such people are excellent practical naturalists) . . . I procured a number of feathers & a piece of the skin from the Indians.[1] These are the only specimens which may be considered as *certainly* belonging to the Petise. Although from what I heard here, & from the rapidly increasing number of this species South of the R. Negro, it is far most probable, that the specimen at Port Desire was a Petise. From the same reasoning, I believe all the ostriches seen on the banks of the S. Cruz April–May 1834 (Lat : 50°) were Petises, & I accordingly collected some feathers. Specimen Number (2004)."

It is clear that in this early draft, Darwin had not yet reached a complete assurance as to the identity of the Port Desire ostrich with the Avestruz Petise ; he still writes that the only specimens which may be considered as certainly belonging to the Petise were those bought from the Indians.

A comparison of these notes of varied dates has convinced me that the order of writing them was as follows :—firstly, the first entries in *C.U.L. Handlist* of specimens, Jan.–Feb. 1834, whilst the events were still fresh in his mind. Secondly the first drafts of the *Ornithological Notes*, probably of several dates, but before April 2nd, 1836, when the Beagle arrived at Keeling Island. Thirdly the dated addition to the *C.U.L. Handlist* of April, 1836, when he was either at Keeling Island, or more likely, on the voyage to Mauritius, between April 12th and April 29th, 1836. (*See* Itinerary of Voyage, p. 210.)

The problem of the overlapping territories of the two Rheas remained lodged in Darwin's mind awaiting solution for the next years, as the references in the *Transmutation Notebooks* (B.M. Bull.) (1837–9) clearly show. There is one entry in one of the small pocketbooks of the voyage[2] that is so relevant to the Petise story that I give it here ; the evidence of the other entries suggests that they were written before reaching England. The passage occurs in one of the last small pocket-

[1] In Beagle Diary, opposite the date Jan. 30th, 1834, p. 207, he wrote :—" The whole population of the Toldos were arranged on a bank, having brought with them Guanaco skins, Ostrich feathers etc."

[2] Not published, except for a few extracts in *V. of B.*, 1945.

books, in which Darwin also quotes remarks of Sir J. Herschel and Sir Andrew Smith at the Cape of Good Hope, May–June, 1836. This pocketbook is slightly larger than most, measuring 4 in. × 6½ in. On the cover is written in large ink letters by Darwin " Nothing for any Purpose ". Front and back covers have square white labels with R.N., also in his writing, and " Range of Sharks " on the end one. Pencil and pen have been used ; many pages have been cut out. On the inside of the front cover is written :—" The living atom having definite existence, those that have undergone the greatest number of changes towards perfection (namely Mammalia) must have a shorter duration, than the more constant. This view supposes the simplest infusoria same since commencement of world." The writing in ink of this passage is unusually neat, and the style suggests the possibility of a copied quotation ; but there was no quotation marks. At anyrate, the thought conveyed was clearly one that deserved preserving for future pondering. Then follow rough geological notes on volcanic action, including the later islands visited in 1836. On p. 79, wedged in between passages on volcanic theory, comes the query :—" Ascencion vegetation ? Rats & Mices. At St. Helena. There is a native Mouse."

That Darwin did use some of the small pocket books for stray jottings after his return is certain, but I think it can be proved that the following suggestions for pursuing lines of enquiry in which the Petise figures so large, were written during the voyage. For we know that he was rearranging and rewriting his geological material for publication before reaching Cape Town,[1] ; these rough drafts must therefore have preceded the writing of the letter dated April 29th, 1836.

[Pocket Book]
p. 127 " Speculate on neutral ground for 2 Ostriches : bigger one encroaches on smaller. — change not progressive : produced at one blow, if one species altered : Mem : my idea of Volc. islands elevated. then peculiar plants created, if for such mere points ; then any mountain, one is falsely less surprised at new creation for large — Australia. = if for volc. isld then for any spot of land. = Yet new creation affected by Halo of
p. 128 neighbouring continent : as if any | creation taking place over certain area must have peculiar character : . . . Great contrast of two sides of Cordillera, where climate similar. — I do not know botanically = but picturesquely = Both N & S great contrast from nature of climate . . . Go steadily through all the limits of birds and animals in S. America.
p. 129 Zorilla : | wide limit of waders : Ascencion : Keeling : At sea so commonly seen at long distances : generally first arrives :—
" New Zealand rats offering in the history of rats, in the Antipodes a parallel case. Should urge that extinct Llama owed its death not to change of circumstances ; reversed argument, knowing it to be a desert.

[1] *V. of B.*, 1945, p. 138, letter to his sister from Mauritius, Ap. 29th, 1836. " Whilst we are at sea & the weather is fine, my time passes smoothly because I am very busy. My occupation consists in rearranging old geological notes : the rearranging generally consists in totally rewriting them."

p. 130 Tempted to believe animals created for definite time : — not extinguished by change of circumstances. The same kind of relation that common ostrich bears to (Petise — & diff kinds of Fournillia[?] extinct Guanaco to recent : in former case position, in latter time (or changes consequent on lapse) being the relation, as in first cases distinct cases inosculate so must we believe ancient ones : not *gradual* change or degeneration. from circumstances : if one species does change into another it must be per saltum — or species may perish. This representation [*altered from* inosculation] of species important, each its own limit, and represented. — Chiloe creeper ; Furnarius, [Caracara *del*] Calandria. inosculation alone shows not gradation : . . . | [*See Addendum*[1] p. 278.]

[Pencil] 132 Propagation, whether ordinary, hermaphrodite, or by cutting an animal in two. (gemmiperous by nature or by accident) we see an individual divided either at one moment or through lapse of ages. — Therefore we are not so much surprised at seeing Zoophite producing distinct animals, still partly united, & egg which becomes quite separate. Considering all individuals of all species as each one individual divided by different methods, associated life only adds one other method where the division is not perfect. |

p. 133 "Dogs, Cats, Horses, Cattle, Goat, Asses, have all run wild & bred, no doubt with perfect success. Showing how creation does not bear upon solely adaptation of animals. — extinction in same manner may not depend. — There is no more wonder in extinction of species than of individual. | [2 pp. cut out.]

p. 138 " Investigate with greater care vegetation & climate of Tristan d.Acunha Kerguelen Land. Prince Edwards Isd., Marion & Crozet. L. Auckland. MacQuaries — Sandwich Isd.

p. 153 " When we see Avestruz two species. certainly different. not insensible change : — yet one is urged to look to common parent ? Why should two of the most closely allied species occur in same country ? In botany instances diametrically opposite have been instanced :"

More rough geological notes follow, which must have preceded the " rewriting " described in the letter of April, 1836, already quoted (footnote p. 276). So that the above notes on the Petise, interlarded with geological jottings, acquire a hall-mark and can be safely dated before April 1836.

Changes of species observed on the voyage up S. America's western coast, where the barriers were apparent, were, I believe, more closely noted and with increased interest and purpose, because of the experience of the two Rheas, where no dramatic barriers divided the two ranges. He already looked ahead into some of the difficulties to be faced. Then, in 1835, came the shock of seeing species differentiation through isolation actually in progress in the different islands of the Galapagos Archipelago, when I think it fair to say that the smouldering ideas broke into a small flame.

ADDENDA

1. On specimen no : 711, and the word "inosculate" (see above, p. 212 and p. 277). In a letter to John Stevens Henslow written from Monte Video on Nov. 24th, 1832, describing a consignment of specimens sent home to Henslow, Darwin wrote :—"There is a poor specimen of a bird, which to my unornithological eyes, appears to be a happy mixture of a lark pidgeon & snipe.—Mr. Mac Leay himself never imagined such an inosculating creature." Bracketed above the line after the word snipe, Darwin added "No : 711". The bird is described in *Z. of B.*, 1841, as *Tinochorus rumicivorus*. The letter to Henslow gives a dated proof that by November 1832, Darwin was familiar with Macleay's *Horæ Entomologicae*, published 1819–1821. The use of the word "inosculating" in conjunction with Macleay's name shows that Darwin had studied the diagrammatic, semi-mystical scheme of creation of *Horae Entomologicæ*, though a judgment of its usefulness to him may be suggested in the use of the subsequent word "imagined". In another context, however, this work may have served to stimulate Darwin to start his eight years' study of the Cirripedes, 1846–1854 (see Sydney Smith, Linn. Soc. Nov. 8th, 1962). Again, in the early note-book quoted above, p. 277, the word "inosculate", or "inosculating", occurs three times in the discussion on species' changes. Loren C. Eiseley has suggested that Darwin took the word from E. Blyth ; probably Blyth also was well acquainted with Macleay's work, and he, like Darwin, drew on Macleay's terminology.

2. On specimen no : 1028 (see above, p. 213.) The capital P preceding Pezoporus refers to *Phalcobænus*, d'Orbigny's generic name ; John Gould altered the name to *Milvago pezoporus*, see *Z. of B.*, p. 13, where the bird is discussed.

INDEX TO VOL. 2

Abegele 4
Abercrombie, John 88
Abinger Hall 19, 20, 21
Abyssinia 27
Acasta 11, 13
An account of the regular gradation in Man, and in different animals and vegetables . 72
Accra 56
Adler, S. 164
Agassiz, Louis 93, 165
alba, Motacilla 57
Albury, near Guildford 18
Alcippe 13
Allen, John Hensleigh 160, 170
Allison, A. C. 131
Alumni Cantabrigienses 6
Amaryllidaceae: preceded by an attempt to arrange the Monocotyledonous orders 63, 109, 135, 137, 139, 172, 176
Amaryllis 64
American Ornithology 89, 90
Amoenitates Academicae 60
Anatifera 12
Anatomy and Philosophy of Expression . 111
The Ancient White Cattle of Britain . . 192
Animal Ecology and Evolution 32
Aplonis. 91
Apollo 27
Appleton, Thomas 17
Apteryx 132
aquatica, Zizania 172
Armadillos 43, 48
Arthrobalanus 11
Ascension 8
Atavism 49, 182
Atlantic dust. 11
Audubon, J. J. L. 191
Australia 38, 43, 48
australis, Apteryx 132
Autobiography of Charles Darwin 3, 4, 26, 35, 36, 37, 40, 123
Avitism 101
Azara, Félix d' 173, 190

Babbage, Charles 87, 157, 165
Babington, Charles Cardale 105
Bachman, John 113, 191, 193
Baer, Karl Ernst von 131
Baer, N. 57, 199
Baird, William 111
Balanus 11, 13
Baly Medal 21
Bangor 6, 10
Banks, Sir Joseph 172
Barclay, John 101
Barlaston, Staffordshire 21
Barlow, Lady Nora 3, 4, 36, 37, 40, 51, 123, 124, 159
Barmouth 6, 18
Barrett, Paul H. 196
Barrington, Daines 104
Bartram, William 180
Bassett, Southampton 18, 19
Bateson, William 158
Beagle, H. M. S. 7, 8, 154
Beatson, Alexander 188
Beaufort, Francis 6
Beck, Henrich Henrichsen . 97, 165, 170
Beck, J. 92
Beechey, Frederick William . . . 252
Belfast 5
Bell, Sir Charles . . . 111, 179, 180
Bell, J. 64
Bell, P. R. 78
Bell, Thomas. . . 45, 64, 67, 73, 150, 194
Bell Stone 5
Bentham, George 40, 155
Bibron, Gabriel 87
Biologie oder Philosophie der lebenden Natur für Naturforscher und Aerzte. . . . 93
The Birds of Australia and the adjacent Islands 47
The Birds of Europe . . 70, 91, 95, 101
Birmingham 9, 12
Bishop's Castle 5
Blackwell, John 89
Blenheim 11
Blumenbach, Johann Friedrich . . . 107
Blyth, Edward 27, 35, 36, 85, 98, 106, 192, 193, 195, 278
Boece, Hector 192
Bonaparte, Charles-Lucien 89
Bonnet, Charles 28
Bonpland, A. J. A. 52
Bory St. Vincent, J. B. G. 188
Boulenger, C. 60
Bournemouth 16
Boycott, A. E. 167
Brand, F. J. 60
Brazil 7
The Breeder's and Fancier's Pedigree Book . 190
Bridgewater Treatises on the Power Wisdom and Goodness of God . 134, 157, 165, 179
Brighton 13

British Association 11, 12, 14
The British Aviary 112
Broderip, William John 136, 165
Brongniart, A. 60
Bronn, Heinrich Georg 83
Brown, Robert . . 52, 110, 112, 174
Bryanston Street 19, 20, 21
Buch, Leopold von 34, 60, 61, 104, 137, 138, 178
Buckland, William . . . 60, 163, 165
Buffon 28, 141, 150
Burnham Beeches 11
Butler, Samuel 4, 37
Butler, Thomas 6
Butterton, George Ash 6

Caerdeon 18
calomelanos, Gymnogramma 169
Cambridge . . . 5, 6, 7, 8, 18, 20, 21
Cambridge University Library . . . 26
Cameron, Mrs. 17
Camp Hill 11
Campbell, Major 56
Candolle, Alphonse de 31
Candolle, Augustin Pyramas de 42, 73, 183
Cape of Good Hope 7, 8, 43
Cape de Verdes 8
Capel Curig 6, 10
Carbonnières, L. E. R. de 173
Carlisle 14
Carmichael, Dugald 64, 65
Carnarvon 10
Carus, Karl Gustav 93
Case, Mr. 4
Catalogue of the Library of Charles Darwin 146
Catalogue of Plants in the Collection of Conrad Loddiges & Sons 142
Catalogue of the Vascular plants of S. Tomé 64
Catophragmus 13
cervus, Lucanus 194
Cetacea 39
Chaetodon 179
Chamaesipho 13
Chamisso, Adelbert von 51
Charles Darwin. The Foundations of the Origin of Species 3
Charles Darwin and the Voyage of the Beagle . . . 25, 51, 124, 204
Chatsworth 11
Chelonobia 13
Chelydra 73
Chillingham cattle 192
Chobham 13
chrysophylla, Gymnogramma 169
Chthamalus 13
cinereus, Circus 196
Circus 196
Cirripedia 12
cisalpina, Fringilla 130
Cleghorn, James 146
Clift, William 96
Cline, Henry 59
Clisia 11
Colburn, Henry 18
Coldstream, John 5
Collection des Suites à Buffon 150
Collins, K. St. B. 6
Colobus 52
Condor 240, 241
Condorcet, Antoine-Nicolas de . . . 156
Conia 11, 13
Coniston 21
Conway 6
Copley Medal 16
Coral formation 7
Corfe Castle 12
cornix, Corvus 171
corone, Corvus 171
Coronula 13
Corvus 171
Cotton, Mr. 5
Coulter, Thomas 70
Covington, Syms . . . 10, 207, 211
Cowper, William 173
Cox, William 113
crassilabrum, Monoceros 170
Crawfurd, John 55
Creswick, H. R. 159, 209
cristatus, Presbytis 62
Cryptophialus 13
Curiosities of Literature 132
Cuvier, Frédéric 55, 101
Cuvier, Georges 33, 34, 48, 50, 51, 54, 137, 176, 195
Cyclemys 73
The Cyclopaedia of Anatomy and Physiology 194

Darlington, C. D. 28
Darlu 57
Darwin, Amy 20
Darwin, Anne Elizabeth . . . 10, 13
Darwin, Caroline Sarah 5, 12
Darwin, Charles 3–278
Darwin, Sir Charles 3, 159
Darwin, Charles Waring 14
Darwin, Emily Catherine 17
Darwin, Emma . 4, 9, 10, 11, 13, 14, 16, 128
Darwin, Erasmus 12, 28, 30, 36, 37, 40, 111, 130, 138
Darwin, Erasmus Alvey 4, 5, 13, 16, 17, 18, 19, 20, 21, 129
Darwin, Francis 3, 13, 19, 20, 34, 37, 40, 122
Darwin, Sir Francis Sacheverel . . 199
Darwin, George Howard 11
Darwin, Henrietta Emma 10, 13, 15, 18, 19, 21
Darwin, Horace 15, 19, 21
Darwin, Leonard 13, 16
Darwin, Marianne 5
Darwin, Mary Eleanor 10

Darwin, Robert Waring . 12, 128, 166, 183
Darwin, Robin 26, 187
Darwin, Susan Elizabeth . . 5, 11, 17
Darwin, Susannah 4
Darwin, William Alvey 5, 6
Darwin, William Erasmus . 9, 18, 19, 20
Darwin's Biological Works . . . 78
Darwin's Century 37
Dasyurus 96
Daudin, F. M. 133
Dawes, Richard 6
de Beer, Sir Gavin 3, 7, 26, 126, 147, 169, 209, 262
De Distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena . . . 60, 138
The Descent of Man and selection in relation to Sex 111
Description physique des Iles Canaries 60, 138
Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London 136, 137, 141
Deshayes, Gérard-Paul . . . 48, 63
The Development of the Vertebrate Skull . 169
Devonshire Street 19
Dictionnaire classique d'Histoire naturelle . 235
Dictionnaire des sciences naturelles, dans lequel ou traite méthodiquement des différens Etres de la nature . . 73, 235
Didelphys 39, 57
Diderot 28
Disraeli, Isaac 132
Diver, C. 167
Dobson, J. 26
Domestic Animals 17
domestica, Fringilla 130
Don, David 189, 199
Don, George 50, 64, 170, 199
Down House 10, 18, 21, 26
Downton 5
Drinkwater 133
Dropmore 11
Drosera 15, 19
Dublin 5
Duchesne, Henri-Gabriel. 182
Dujardin, Félix 134
Duméril, André Marie Constant . . 71
Dundee 5
Dupetit-Thouars, L. M. A. A. . . . 34
D'Urville, J. 83

Earl, George Windsor 161
Eastbourne 13, 15
The Eastern Seas or Voyages and Adventures in the Indian Archipelago . . . 161
Edentates 38, 53, 57
Edinburgh 5, 8
Edinburgh New Philosophical Journal . 36
Edwards, Henri Milne- . . 54, 136, 170
Edwards, William Francis . 174, 175, 183
The Effects of Cross- and Self-fertilization in the Vegetable Kingdom . . . 20
Egypt 43
Ehrenberg, Christian Gottfried 43, 60, 83, 98, 143, 147, 148
Eichwald, Carl Eduard von . . . 165
Eiseley, Loren 28, 31, 33, 35, 36, 37, 278
Elements of Geology . . . 136, 171
Elements of Physiology . . . 168, 174
Ellegard, Alvar 123
Ellis, William 65, 67
Elminius 13
Elston 12
Elton, Charles 32
Enquiry concerning political justice and its influence on virtue and happiness . . 156
Entomology 5
Erewhon 4
Erpétologie générale ou Histoire complète des Reptiles 71
Erskine, Cecilia 19
Escuria. 13
Essai élémentaire de géographie botanique 42, 73
Essai sur les animalcules spermatiques . 183
Essai sur la géographie des plantes . . 52
Essais sur l'histoire naturelle des quadrupèdes de la province du Paraguay . . . 173
An Essay on Animal Reproduction . 169, 178
Essays on Natural History chiefly Ornithology 195
Essay on the Principle of Population 26, 153, 160
Essay on the theory of the earth . . 48, 51
Ethiopians 27
Evolution 31
Evolution in Biology 156
Evolution by National Selection 3, 10, 26, 132
Evolution as a Process 31
Exell, A. W. 64
Expédition scientifique de Morée . . 87
The Expression of Emotions in Man and Animals 19
Extracts from Letters addressed to Professor Henslow 36
Eyton, Thomas Campbell 57, 58, 61, 66, 71, 95, 128, 131, 132

Falconer, Hugh 72
Falkland Islands 11, 38
Falmouth 7
A Familiar History of Birds . . 175, 193
Farrer, Emma Cecilia 21
Farrer, Lord 19
Fauna Boreali-Americana 51, 90, 95, 164
Feibleman, J. K. 124
Felis 85
Ferguson, William 131
Ferussac, A. É. J. P. J. d'A. . . . 112
Firth of Forth 5

Fisher, Sir Ronald . . 28, 31, 34, 157
FitzRoy, Robert 6, 7
flava, Motacilla 57
Fleming, John . . 72, 99, 100, 171
Fletcher, Mr. 11
Flustra 4, 5, 37
Forbes, Edward 169
Ford, E. B. 31
The formation of vegetable mould through the action of worms 21
Forster, John Reinhold 87
Forster, Laura May 21
Foundations of the Origin of Species . . 10
Fountain, Sybil 209
Fox, Samuel 6, 7
Fox, William Darwin 5, 6, 51, 57, 58, 63, 64, 129, 138, 199
Freshwater, Isle of Wight . . . 17
Fringilla 130
Fries, B. F. 148, 169
Fries, Elias Magnus 47
Fucus 5
Fuller, B. 265

Gaimard, J. P. 48, 82
Gallesio, Giorgio 182
Garnot, Prosper 45, 83, 84
Garstang, S. L. 167
Gautrey, P. J. . . 26, 159, 187, 209
The Genera of Recent and Fossil Shells 112, 163
Genesis 27
The Genetical Theory of Selection . 28, 157
Geoffrey-Saint-Hilaire, E. 35, 40, 53, 54, 55, 57, 73, 138
A Geographical and Comparative List of the Birds of Europe and North America . 89
Geological Observations on the Volcanic Islands 10
Geology and Mineralogy considered with reference to Natural Theology . . 60
Geology of the Voyage of H.M.S. Beagle 8
Glasgow 5, 14
Glenrhydding House 21
Glen Roy 8, 133
Godstone 13
Godwin, William 156
Gould, John 47, 57, 62, 70, 77, 82, 91, 95, 98, 101, 105, 271, 278
Gower St. 9
Graah, Captain 172
Graham, Andrew 62
Grant, C. W. 137
Grant, Robert Edmund 5, 36
Gray, Asa 34
Gray, John Edward 42
Greenock 8
Gt. Marlborough St. 7
Gros 4
Guillemin, J. B. A. 189
Gymnogramma 169

Habits and Instincts of Animals . . 36
Hall, Webb 192
Hamilton, William John 87
Hardy, A. C. 31
Haredene, Albury, near Guildford . . 18
Hartfield Grove . . 12, 13, 14, 15, 16
Hastings 13
Hawkshaw, Sir John 20
Hawkshaw, John Clarke 20
Hawkshaw, Mary 20
Head, Sir F. B. 234
Heber, Reginald 111, 182
Helarctos 62
Henslow, John Stevens 6, 35, 36, 49, 69, 83, 93, 105, 180, 189, 278
Herbert, John Maurice 6
Herbert, William 11, 35, 63, 64, 95, 109, 135, 137, 139, 172, 174, 176
Hermitage 13
Heron, Sir Robert 128
Herschel, Sir J. 263, 276
Hertwig, Oskar 126
Heterostyled Plants 20
hibernicus, Mus. 188
Hillhouse, William 56, 188
Hindmarsh, J. 191, 192
Histoire naturelle des animaux sans vertèbres 31, 138
Histoire naturelle des Crustacés . . . 136
Histoire naturelle, générale et particulière des reptiles 133
Histoire naturelle générale des Pigeons et des Gallinacés 85
Histoire Naturelle et particulière des Mollusques terrestres et fluviatiles . . 112
Histoire naturelle, Quadrupèdes . . 141
Histoire des Poissons 54
A History of British Animals . . . 171
A History of British Birds . . 94, 193
A History of British Quadrupeds 45, 64, 67, 150
History of Chili 245
History of the Inductive Sciences . 132, 166
Hobart Town 8
Hodgson, Bryan Houghton . . . 182
Holland, Henry 182
Hollycombe, Sussex 20
Holmes, S. C. A. 63
Hope, Frederick William . . 71, 110
Hopedene, Surrey 20
Horae entomologicae . 29, 36, 56, 73, 107, 136
Horsburgh, James 181
The Horse, with Treatise on Draught . . 150
Horsfield, Thomas 62, 135
Hottentots 45
Hubbersty, Nathan 5, 183
Humboldt, F. H. A. von 35, 45, 52, 58, 60, 138
Hunter, John 61, 136, 137, 141, 142, 144, 145, 146, 194
Hutton, Thomas 181
Huxley, Sir Julian 31, 126

Huxley, T. H. . . 78, 123, 124, 156
Hydrogéologie 93, 138

Ilkley 15
Illustrations of the Botany and other Branches of the Himalayan Mountains 70, 72, 188
Illustrations of the Zoology of South Africa 134, 140
India Directory 181
Inquiries concerning the Intellectual Powers and the Investigation of Truth . . 88
An Inquiry into the opinions, ancient and modern, concerning life and organization 101
Insectivorous plants . . . 19, 20
Intermarriage 173
An Introduction to the Natural System of Botany 73
Isle of Wight. 7, 11
Itinerary of Voyage of H.M.S. Beagle . 210
Jacob 27, 28
Jameson, Robert 8
Java 49, 50
Jeffrey, Lord Francis 109
Jenner, Sir William 16
Jenyns, Leonard . . . 45, 67, 83, 171
Jespersen, P. H. 37
Jevons, W. S. 124
Jones, R. 133
Jones, T. Rymer 147
Journal historique d'un voyage fait aux Iles Malouines 266
Journal of Researches into the Natural History . . . during the Voyage of H.M.S. Beagle . . 11, 45, 59, 162, 193, 240
Journey through the Upper Provinces of India 111, 182
Juan Fernandez 38

Kant, Immanuel 28
King, Phillip Parker . . 88, 92, 251
King George Sound 8
Kirby, William . . . 6, 36, 58, 59
Knight, Thomas Andrew 167, 178, 179, 180, 182
Knole Park 11
Kotzebue, Otto von 51
Krause, Ernst 37

Laban 27, 28
Lagostomus 85
Lamarck, Jean Baptise de 28, 30, 31, 32, 36, 40, 42, 56, 67, 89, 93, 102, 163, 177, 180
Lamprotornis 91
Langton, Charles 12, 17
Langton, Emily Catherine . . . 17
laniarius, Dasyurus 96
Lanius 91
L'atomisme en biologie 28
Latreille, P. A. 83
Lavater, John Caspar 146
Lawrence, William. 107
Lectures and Essays 124
Lectures on physiology, zoology, and the natural history of man 107
Leith Hill Place . . 12, 13, 15, 16–21
Lepadidae 13
Lepus 48
Lesson, René—Primevère 45, 83, 84, 223
L'état présent du transformisme . . 31
A letter on the dying struggle of the Dichotomous system 99, 100
Levaillant, Francois 95
L'évolution des espèces 28
Lichfield 12
Life and Letters of Charles Darwin 3, 34, 37, 40, 122, 123, 124
The Life Letters and Labours of Francis Galton 200
Lincolnshire 11
Lindley, John 47, 73
Linnaeus, Carolus 60, 100
Linum 16
Litchfield, H. E. 4, 19
Litchfield, Mrs. 10
Liverpool 4, 8
The Living Thoughts of Darwin . . 126
Llangollen 6
Loddiges, Conrad 142
Logic 124
London . . . 5, 6, 7, 8, 9, 10, 11
Longfellow, Henry W. 17
longifolia, Amaryllis 64
Lonsdale, William 103, 104
loreus, Fucus. 5
Lowe, Captain 248
Lowe, Richard Thomas 65
Lucanus 194
Lucretius 28
lugubris, Motacilla 57
Lyell, Charles 27, 31, 32, 33, 36, 37, 40, 42, 49, 52, 55, 60, 61, 62, 63, 87, 90, 92, 99, 102, 104, 136, 156, 160, 162, 165, 166, 170, 171, 175
Lythrum 16

MacCulloch, John 48
Mackintosh, Sir James 5
MacLeay, William Sharp 29, 36, 47, 56, 63, 73, 99, 100, 101, 107, 134, 136, 140, 161, 278
Maer Hall 5, 7, 8, 9, 10
magellanicus, Lepus 48
malayanus, Ursus 62
Malthus, T. R. . . 26, 39, 40, 153, 160
Malvern 12, 13, 16
Manners and Customs of the Ancient Egyptians 176
Mantell, Gideon 101
A Manual of British Vertebrate Animals 45, 171
A Manual of the Elements of Natural History 107
Manual of Scientific Enquiry . . . 12

Manuel du Naturaliste 182
Manual d'Ornithologie 223, 249
Marler, P. 78
Marriage 9
Marsupials 39, 43, 53
Martens, Martin . . 70, 169, 271, 275
Martin, William 52, 188
Matthew, Patrick 27
Maupertuis 28
Mayo, Herbert 134
Mayr, E. 35
Medical Notes and Reflections . . . 182
Megatherium 38, 43, 48, 162
Megatrema 11
Mémoires sur divers sujets de l'histoire naturelle des insectes, de géographie ancienne et de chronologie . . . 83
Memoirs of the Life of the Right Honourable Sir James Mackintosh 109
Mendel, Gregor 28
Milvago 278
Mitchell, Sir Thomas Livingstone 96, 138, 139, 190
Molina, J. I. 245
Monoceros 170
A Monograph on the Anatidae . . . 131
A Monograph of the Fossil Balanidae and Verrucidae of Great Britain . . . 13
A Monograph of the Fossil Lepadidae . 13
A Monograph of the Sub-class Cirripedia . 13
Montagu, George 86
Montague Street 19
montanus, Pomatorhinus 133
Monteith, William 56
Montgomery 5
Moor Park 14, 15
More Letters of Charles Darwin . 3, 37, 122
Morgan, T. H. 28
Morton, George *Earl of* 63, 128, 146, 147, 168, 189, 194
Motacilla 57
The Movements and Habits of Climbing Plants 19
Müller, Johannes 168, 174
Murchison, Roderick Impey . . . 73
muricata, Pontobdella 5
Murrays Sale. 19
Mus 188
muticus, Pavo 85
Myothera 256

Narrative of an Expedition to explore the River Naire, usually called the Congo 110, 112
Narrative of the surveying voyages of H.M.S. Adventure and Beagle 251
The Natural History and Antiquities of Selbourne 112, 191
The natural history and classification of birds, Lardner's Cabinet Cyclopaedia . . 29
atural Theology 155
Nature 4, 5
neglecta, Motacilla 57
Netley Abbey 11
Newman, Edward 29, 47
Newport, G. 126
New Biology 131
New Zealand. 8, 48
nigritarum, Pediculus 58
Nomenclature of Colours 224
Norman, Ebenezer. 11
North Wales 5
Novae Zelandiae, Polyborus . . 193, 196
Nuneham 11

Observations on the Breeding and Form of Domestic animals 59
Observations on certain parts of the Animal Oeconomy . 61, 141, 142, 144, 145, 194
Observations made during a Voyage round the World, on Physical Geography . . 87
Observations sur la classification methodique des oiseaux. 131
Observations upon the instinct of Animals 96, 101
Octomeris 13
Ogilby, John Wandesford . . . 62
Ogilby, William 62, 83, 86
Old Testament 27
On the connexion of the physical sciences . 109
On the form of animals 59
On the Influence of Physical Agents . . 174
On the Kingdoms of Nature, their Life and Affinities 93
On the Origin of Species by means of Natural Selection 4, 14, 26, 36, 37, 165, 187, 207
On the power, wisdom . . . in the creation of animals 58
On the various contrivances by which Orchids are fertilized by insects . . . 16
Orbigny, Alcide Dessalines d' 88, 89, 92, 95, 101, 168, 242, 249
Orbigny, Charles d' 104
Orchids 15, 16, 17, 20
Ornithological Biography 191
Ornithological Notes . . . 203–278
Ornithorhynchus 50, 51
Osmaston Hall 6
Ostriches 43
Overton 8
Owen, Richard 43, 61, 62, 82, 85, 132, 136, 141, 142, 144, 145, 171, 175, 194, 244
Oxford 11

Pachidermata 49, 60
Pachylasma 12
pajeros, Felis. 85
Paley, William 35, 155
Pampas 7
Papers relating to the Devastation committed by Goats on the Island of St. Helena . 188

paradoxus, Ornithorhynchus . . . 50
Paris 5
Park Street 13
Park, Thomas 56
Parker, Henry 5
Parker, Marianne 14
Patterdale 21
Pavo 85
Peacock, Mr. 6
Pearson, Karl 200
Peccari 57
Pediculus 58
Pentland, Joseph Barclay . . . 66
Pernety, A. J. 266
Péron, Francois 83, 188
Personal Narratives of Travels to the Equinoctial Region . . . 58, 138
pezoporus, Milvago 278
Phaethon 27
Phalocoboenus 278
Phillips, John 62
Philochelidon 189
Philosophie anatomique. Des Monstruosités humaines 55
Philosophie Zoologique 30, 31, 32, 56, 66, 102, 138, 177, 180
The Philosophy of Living 134
The Philosophy of Natural History . . 72
The Philosophy of Zoology . 72, 99, 100
Phocea 39
Physiologie végétale 183
Pipe-fish 165
Pistyll Rhayader 4
Planariae 11
Plas Edwards 4
Plata 7
Platylepas 13
Platypus 39
Plinian Soc. 5
Plymouth 7
Political essay on the Kingdom of New Spain 45
Polyborus 193, 196
Polynesian researches, during a residence of nearly eight years in the Society and Sandwich Islands . . . 65, 67
Pomatorhinus 133
Pontobdella 5
Poole 12
Portsmouth 11
Powell, Baden 26, 37
Power of Movement in Plants . . . 21
Presbytis 62
Prichard, James Cowles 107
Primula 16
Principes de Philosophie Zoologique 54, 55, 73, 138
Principles of Geology 31, 32, 33, 35, 42, 49, 52, 55, 60, 61, 63, 87, 90, 92, 99, 102, 156, 160, 162, 165, 166, 171
Pringsheim, N. 126
Proposal of marriage 8
Pteroptochus. 256
Pyrgoma 13
pyrrhus, Semnopithecus 62

Quarterly Journal of Agriculture . . 134
Quinarian theory 29, 47
Quoy, J. R. C. 48, 82

Ramsay, Marmaduke 6
Ramsgate 12
rattus, Mus 188
Ray, John 112
Recherches sur les Ossemens Fossiles des Quadrupèdes 137, 195
Recherches sur les Poissons Fossiles . . 165
Le Règne Animal 50
Reigate 13
Reise durch Norwegen und Lappland. 104, 178
Reliquiae Diluvianae or Observations on the Organic Remains in Caves . . 163, 165
Report on the expedition for exploring Central Africa 45, 95, 99
Researches into the physical history of Man 107
Rhinoceros 49, 50
Rhyncops 221
Rich, Anthony 21
Richardson, Sir John . . . 51, 95, 164
Rio Plata 7
Rostand, Jean 28, 31
rostratus, Chaetodon 179
Rough notes of journeys in the Pampas and Andes 234
Rowlands, M. J. 159
Royal College of Surgeons . . . 26
Royal Medal 13
Royle, John Forbes . 70, 72, 109, 188
Ruck, Amy Richenda 19
Rugby 13
Ruthven 6

St. Andrews 5
St. Cross 11
St. Helena 8
St. Jago 7, 8
Salisbury Craigs 8
Sandown 14
Sand Walk 21
Science and the Humanities 147
Scotorum Historiae 192
Sebright, Sir John 94, 96, 101, 140, 150, 193
Sedgwick, Adam 6
Selborne 14
Selby, Prideaux John 190
Select dissertations from the Amoenitates Academicae 60
Semnopithecus 62
sensitiva, Smithia 183
Serres, A. E .R. A. 62
Serres, Marcel de 188

Sessilia 12
Sevenoaks Common 19
Seward, A. C. . . . 3, 37, 122
Shanklin 14
Shrewsbury . 7, 8, 9, 10, 11, 12, 13, 14, 18
Shrewsbury Parish of St. Chad . . 4
Shrewsbury School. 5
Shropshire 6
Siberia 49
Sketch for a Historical Picture of the Progress of the Human Mind 156
Skramovsky, M. . . 26, 159, 187, 209
Sloths 43
Smellie, William 72
Smith, Sir Andrew 45, 49, 51, 62, 63, 85, 95, 99, 134, 140, 143, 147, 263, 276
Smith, James 180
Smith, Sydney . . . 81, 159, 209
Smithia 183
Sobol, S. L. 159
Somerville, Mary 109
South Africa 38, 49
South America . 6, 11, 34, 38, 39, 42, 49
Southampton . . 11, 16, 18, 20, 21
Sowerby, George Brettingham 13, 163, 167, 170
Sowerby, James 112
Spallanzani, Lazzaro . . . 169, 178
Spence, William B. 130
Spencer, Lord 134
Sphinx vespiformis: an essay . . . 29
Spix, Johann Baptiste von . . . 89
Spring Gardens 6
Stafford 18
Stanley, Edward . . . 175, 176, 193
Stauffer, Robert C. . . . 187, 209
Stearn, W. T. 60
Stern, C. 28
Stirling 5
Stokes, Mr. 268
Storia della Riproduzione Vegetale . . 182
Strickland, Hugh E. 87
Structure and Distribution of Coral Reefs . 8
Sudbrooke Park 15
Sumatra 49, 50
Sus 95
Swainson, William . . 29, 49, 52, 73, 90, 102
Swanage 12
Sykes, William Henry . . . 140, 150
Syllabus of an elementary course of lectures on comparative anatomy by Richard Owen 85
Symonds, Sir William 12
Syndics of the Cambridge University Library 3
Systema Naturae 100
Systema Orbis Vegetabilis . . . 47

Taenia 134
Tankerville, Earl of 191
Tapirus 171
Taylor, Richard 93
Temminck, Coenraad Jacob . . 85, 131
Tendril paper 16, 17
Teneriffe 6
Tennyson, Lord 17
Thompson, Henry 110
Thompson, William . . . 104, 188
Three expeditions into the interior of eastern Australia 96, 138, 190
Tierra del Fuego 7
Tollet, Mr. 160
Torquay 15, 16
Townsend, A. C. 159, 209
Transformism 31
Transmutation of Species . . . 7, 25
Travels in Brazil 89
Travels through North and South Carolina . 180
Treatise on British Cattle 150
A Treatise on Domestic Pigeons . . 140
A treatise on the geography and classification of animals 49, 52, 73
Treatise on Geology 62
Treviranus, Gottfried Reinhold . . 93
trichodactylus Lagostomus . . . 85
Tristan d'Acunha 34, 39, 65
Tubicinella 13
Tulune Studies in Philosophy . . . 124
tumidus, Mus 188
Turdus 91
Turner, F. M. 167
Turpin, Jean-Pierre-Francois . . . 110

University Library Cambridge, Darwin MS. 3
Ursus 62

Van Diemen's Land 48
Variation of animals and plants under domestication 34, 36, 62, 63, 94, 128, 134, 140, 160
Venn, J. A. 6
Verruca 13
A view of the cultivation of fruit trees, and the management of orchards and cider . . 113
Vigors, Nicholas Aylward . . 89, 133
Virlet d'Aoust, Pierre-Théodore . . . 87
Vivisection Commission 20
Voyage autour du Monde exécuté pendant 1836, et 1837 sur la Bonite . . . 87
Voyage autour du Monde . . . sur . . . la Coquille 45, 83, 84
Voyage Autour du Monde . . . Uranie & Physicienne 48
Voyage dans l'Amérique méridionale 88, 89, 92, 95, 101, 242
Voyage . . . dans l'intérieur de l'Afrique, par le Cap de Bonne Esperance . . 95
Voyage dans les quatre principales iles des Mers d'Afrique 188
Voyage de découvertes de l'Astrolabe. Zoologie 82

Voyage de découvertes aux terres australes 83, 188
A Voyage of Discovery into the South Sea and Beering's Straits 51
Voyage aux régions équinoxiales du Nouveau Continent 52

Wagner, Moritz 35
Walker Alexander 173
Wallace, Alfred Russel 26, 37
Wareham 12
Waterhouse, George Robert 48, 49, 50, 61, 85, 161, 188
Waterton, Charles 11, 195
Way, Albert 5
Wedgwood, Cecily Mary 20
Wedgwood, Charlotte 12
Wedgwood, Emma 4, 8
Wedgwood, Francis 20, 21
Wedgwood, Godfrey 20
Wedgwood, Hensley . 20, 101, 111, 177
Wedgwood, Josiah 4
Wedgwood II, Josiah 5, 10, 20
Wedgwood III, Josiah 5, 12
Wedgwood, Katherine Euphemia . . 19
Wedgwood, Sarah Elizabeth 11, 12, 14, 16, 21, 177
Wells, William Charles 27
Wellsted, R. 47
Westminster Review 123
Westwood, John Obadiah . . . 58
Westminster Abbey 21
Whewell, William . 87, 132, 134, 166, 174
White, Charles 72
White, Gilbert 112, 141
Whitehead, G. K. 192
Wilkinson, J. 96
Wilkinson, John Gardner . . 176, 177
Willis, Mr. 110, 131, 146
Wilson, Alexander 89, 90
Winchester 11
Windsor 8
The Wisdom of God manifested in the Works of Creation 112
Wollaston Medal 15
Woodhouse 5
Worthing 20, 21
Wynn, M. B. 190
Wynne 58, 94

Xenobalanus 13

Yarrell, William 57, 58, 62, 82, 94, 138, 139, 140, 144, 173, 192, 193
York 11
York Place 14
Youatt, William 150

Zirkle, Conway 27, 156
Zizania 172
Zoological Researches in Java and the neighbouring islands 62
The Zoology of Captain Beechey's Voyage . 170
Zoology of the Voyage of H.S.M. Beagle 8, 83, 85, 171, 196, 204, 206, 240
Zoonomia; or, the laws of organic life 29, 30, 41, 111, 130, 138

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